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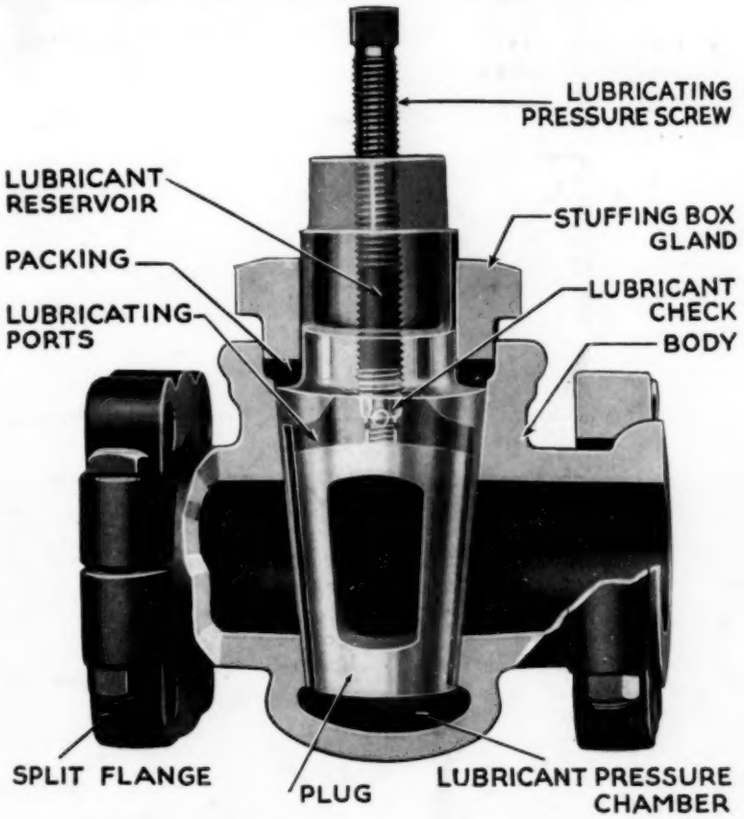

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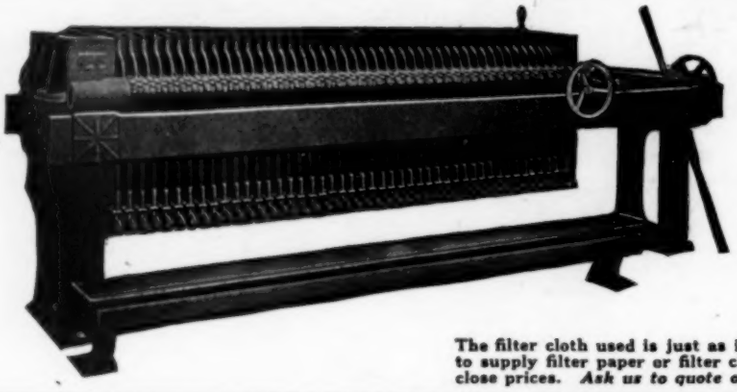

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CHEMICAL & METALLURGICAL ENGINEERING

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German Wages and Export Policy Retard Business Recovery

AT THE OPENING of the forty-fourth general meeting of the Society for the Protection of the Interests of the German Chemical Industry (Verein zur Wahrung der Interessen der Chemischen Industrie Deutschlands) in Leipzig last September, Dr. C. DUISBERG, chairman, gave an address on the economic status of the German chemical industry in 1921-1922. Dr. DUISBERG is the head of the famous Farbenfabriken vorm. Fried. Bayer at Leverkusen and of the powerful German chemical trust, Interessen Gemeinschaft. He is, in fact, the active as well as the nominal leader of the German chemical industry. He is not a mere figurehead of the ex-Wilhelm II or Stinnes type, and hence his utterances not only carry much weight in Germany but must not be overlooked outside of that country.

In his address Dr. DUISBERG spoke solely from the German viewpoint and presented statements that can only deepen the ill-feeling of the German intellectuals toward their former enemies. At the same time he did not even remotely touch on matters that we know they ought to know. Thus he blamed the French for the present German coal situation, when a mere analysis of official German figures made public April 1, 1922, will show that there is no foundation for this attitude. His figures on comparative export values of German products in gold marks and paper marks are quite devoid of any units of weight or measurement that would give them genuine value, especially when we know that German export selling prices for the period he mentions were only a fraction of the intrinsic value of the exported products. His wailing about the plight of German scientists, students and workmen presents the true situation, just as true as the absence of German research, which he also bemoans.

But he does not mention the fact that all of these regrettable conditions are the inevitable result of the exploiting policy of industrials like himself, who pay their workmen abnormally low wages and dump the products of their work at prices far below their intrinsic value.

The remedies he suggests, in addition to the ever-fixed idea of the abrogation of the treaty of Versailles, are more work, more export and less import. But these are mere words, because no one knows better than he that this has been Germany's policy ever since the armistice. What good can be accomplished by such a policy as long as labor is remunerated with only a fraction of its due reward and export prices are far below the intrinsic value of the products?

It is high time for German industrials of the Duisberg type to inaugurate a policy that will prove to be a genuine remedy—namely, the payment of wages compatible with the honest due of the workmen and the sale of their products at prices commensurate with their intrinsic value. It is idle merely to repeat over and over again the present plight of the Germans. They must go to the root of the trouble and eradicate the cause which, besides sapping the vitality of the masses by undernourishment and mental discontent, is gradually bringing the country to the brink of irremediable weakness.

Honest work and honest competition should be the slogan of the German industrials, and it is incumbent upon men like Dr. DUISBERG to lead in this direction.

It may be set down as fundamental in the restoration of normal industrial conditions in Germany that the German workman must be honestly paid for his work.

Strikes and the Public's Rights

IT IS specious reasoning that couples "the right to strike," as a general principle, with "human liberty" and the impropriety of "compelling any man to work against his will." The right to strike, as supported either by law, by ethics or by the public conscience, is merely the right of collective bargaining, granted for the purpose of placing employees on equal terms with employers. Human liberty requires that the employee be at no disadvantage.

But when a strike is directed against the general public, or when the general public is seriously affected by it, an entirely different case is presented. The difference is illustrated by the recognized illegality of the secondary boycott. That illegality rests upon the fact that the secondary boycott seeks to get a third party to enter a dispute between the two original parties.

That strikes, as we have been having them lately, work an injury to the general public is already well recognized. Remedy is another matter, for means must be developed. Even if a suitable remedy were fully and clearly formulated, however, there would still have to be a much stronger public sentiment than now exists in order to make it effective. The inherent difficulty is that majorities feel that their interests will naturally be taken care of, while minorities realize that they must organize and fight. The general public does not realize how much it has lost by the recent coal strike. It comforts itself in paying present coal prices by reflecting that they might be higher still, largely overlooking the fact that the price for bituminous is about double that ruling before the strike. It looks as if the United Mine Workers had obtained a large advance in wages, when what really happened was that the operators lost in their effort to reduce wages.

The public can formulate a doctrine that it will protect workmen to the extent of seeing that they are placed upon equal bargaining terms with their employers. But it will certainly deny that they have a right to be stronger than their employers, just as it has refused to support a system that would make the em-

ployers stronger than their employees. At the same time it must insist that the parties do not get into a dispute that will be inimical to the general welfare. This is no unreasonable bill of rights for the public to adopt. What is needed is a crystallization of sentiment and a recognition of the fact that the majority needs to be organized and articulate.

Enlightened Conduct Of Corporations

WE HAVE lately observed a great combination of manufacturers of chemicals, the principal figure in which is said to have felt that the separate concerns did not avail themselves of all the profits which the market afforded. But we are reminded that the U. S. Steel Corporation saved itself from the charge of monopoly by this very apparent fault. In an article on "The Revival of Mergers," by J. BARTON NEALY in *The World's Work* for October, he says of the Steel Corporation: "In times of prosperity it sold at a uniformly low price, satisfied with a fair return, while its competitors charged all the traffic would bear. In times of depression it became one of the country's most stabilizing influences, spending millions in expansion to maintain employment, extending millions in credit, both here and abroad, thereby retaining its foreign and domestic trade, and last, but not least, loaned millions in the open market to those less fortunate." Under less enlightened administration of the corporation there would have been far greater dividends, but the company would have been disbanded.

Let us cite another example of what our old friends Uncle Dan'l Dollardoodle and Mr. Quickturn Capital would probably call the silly foolishness of the Standard Oil Co. We quote from a letter of the late Lord NORTHCLIFFE to the late WALTER H. PAGE. The letter was dated Manchester-by-the-Sea, Mass., Aug. 13, 1917:

> In great privacy let me tell you of an enormous responsibility that was placed on my shoulders one midnight, in the form of a desperate cable from A. J. B. (Mr. BALFOUR) as to the immediate putting of our fleet out of action owing to an apparently suddenly discovered great shortage of oil. I had been here only a few days, but long enough to know that such fuel was already scarce here. I knew that such a cable, if disclosed, could cause such a jump in the oil market as had never been known. I was up bright and early, I can assure you. A little cautious pussyfooting as to the oil fuel situation brought no comfort—great demand, small supply—nothing doing. I read and re-read that telegram, and finally called up the Standard Oil head man. We met, and I gave him the cable to read, despite its *"Most Urgent Most Secret"* inscription. He read it slowly twice, gave it back to me, saying, "If it can be done, it will be done." I said nothing whatever about price. Those people started right in there, and oil is pouring across the Atlantic with giant strides and at a lower price than we have averaged over here. They could have squeezed millions out of our trouble, if they had chosen. When I thanked them they merely remarked, "It's our war as well as yours."

These are obligations that the purely commercial mind cannot see. Such acts cost money and "waste" dividends. And yet the old captains of industry who direct the affairs of these corporations have learned from experience that a corporation is a thing with obligations and duties that cannot be found in any book of rules that may be compended. It is difficult for the speculator to learn this, and indeed some manufacturers never learn it. The bigger a corporation is the harder it is to practice it, and yet that very human quality is necessary to long-abiding and eventual success. Failure to attain it may encourage quick profits, but it also instigates slow death.

Cementing Anglo-American Friendship and Unity

FRESH impetus was given last month to the cause of Anglo-American friendship and unity by the visit to the United States of a group of editors and publishers of English business and technical papers. They came as delegates to the annual meetings of the Associated Business Papers, Inc., and the National Conference of Business Paper Editors. In addition to participating in the sessions of these two organizations and exchanging views on publishing and editorial problems, they subsequently visited appropriate industrial centers and gathered impressions of business and economic conditions in this country. In the short time at their disposal they doubtless saw so much and in such rapid succession that their impressions resembled nothing so much as the striking but fleeting patterns of a kaleidoscope. But out of it all there crystallized certain general views in the minds of our visitors that must inevitably make for a better understanding in England of some American problems and conditions.

Prominent among the British visitors was F. E. HAMER, editor of *The Chemical Age*, London, who, we are happy to say, was a most creditable representative of British chemical industry as well as its technical press. In the Chemists' Club, where he resided during his stay, he proved himself a delightful companion, and on several occasions demonstrated his capacity as a forceful and well-informed speaker.

The note of Anglo-American friendship that he sounded in his speech at the banquet of the Associated Business Papers and which was reflected also in messages that he brought from Lord RIDDLE, Earl BALFOUR, Lord ROBERT CECIL, Viscount BURNHAM, Sir ERNEST BENN, Sir WILLIAM BERRY and C. P. SCOTT, editor of the Manchester *Guardian*, gave additional evidence of the spirit of harmony prevailing among the leaders of thought in the two nations. Mr. HAMER'S own impressions of the United States, penned briefly before he sailed and published elsewhere in this issue, will be read with no little gratification by chemists on both sides of the Atlantic.

Proposing a Chemical Exposition Course of Study

AMONG the recognized purposes of the Chemical Exposition as it has been conducted for the past 8 years, is that of educating not only the public to an appreciation of the value of chemistry in our national life but also students of chemical engineering and industrial chemistry who are still in their undergraduate years. No doubt both these classes have been benefited in large measure as a result of the efforts that have been made in their behalf, but it begins to look as though a great opportunity for service has been overlooked in connection with the student group.

The particular attention of teachers of industrial chemistry and chemical engineering is directed to a communication in this issue from Prof. W. T. READ, of the Sheffield Scientific School of Yale University, in which he outlines a plan followed with undergraduate students of chemistry for the past 3 years. He has made use of the Chemical Exposition as a vast laboratory for instruction in chemical equipment and fundamental processes. The success of his work has been so striking that the annual visit to the exposition has become a requirement in Sheffield courses in industrial chemistry and chemical engineering.

But this is not enough. As Professor READ points

out, the plan is capable of extension by simply multiplying the number of institutions participating. If this were accomplished, however, it would be necessary to organize the work thoroughly so that there would be no duplication of work and no conflict of groups of students going unsystematically about the exposition. We think we can see in Professor READ'S suggestion the possibility of organizing a one week's course at the exposition for students from nearby colleges and universities. Arrangements could be made with specialists for lectures on fundamental processes, and such lectures could be supplemented by explanation at the booths of typical apparatus on exhibition. Professors in charge of the different groups of students could hold their own lectures and quiz sections and use their own devices for making the most out of the week's study.

The exposition management has here an exceptional opportunity to render service of immeasurable value. We suggest that an impartial committee be appointed to draft a tentative schedule of lectures and systematic inspection of exhibits, and submit the plan to professors in colleges within a radius of a few hundred miles of New York, soliciting their co-operation. With this as a nucleus it will be possible to evolve an excellent course; and if a high standard is maintained in the selection of lecturers and if the attending professors make the most of the exhibits, we think that the annual "Chemical Exposition Course" will become a popular requirement in universities that are close enough to New York to avail themselves of it.

What Is Steel?

THAT question ought to be easy to answer. We have a very large and very authoritative dictionary and we shall go to it. It says:

> Steel. A variety of iron intermediate between cast iron and wrought iron, very tough and, when tempered, hard and elastic.

Evidently, to understand this, we shall also have to look up two more definitions.

> Cast Iron. The direct product of the blast furnace or of the cupola, fusible and brittle. It can be tempered, but not welded or forged.
>
> Wrought iron. The purest form of iron commonly known in the arts, containing only about half of one per cent of carbon. It is tough, malleable and ductile.

It's pretty difficult to strike a position "intermediate" between these two definitions, except for carbon content, since the terms used to describe the properties are relative. As a matter of fact, cast iron usually contains 3½ to 4 per cent of carbon, steel anywhere from 0.1 to 1.4 per cent, and wrought iron is quite low in carbon (0.05 per cent, rarely going higher than 0.25).

But how about the ordinary physical properties? From a recent textbook on strength of materials we find the following data:

	Gray Cast Iron	0.4 Steel (Hot-Rolled)	Wrought Iron
Tensile strength	26,000	85,000	50,000
Reduction in area....	Very low	43	30
Brinell hardness	150	165	85

Evidently this particular steel is not intermediate in strength, ductility or hardness; it is intermediate only in its chemical composition. The dictionary definition is scarcely satisfactory.

Now turn to the steel makers, who certainly ought to be able to recognize their product. Dr. JOHN A. MATHEWS recently commented on the fact that steel has often been defined as the product of certain commercial manufacturing processes. But that leads to an argument every time a new process is discovered—can its products be called steel truthfully? Since his corporation makes steel by various methods, he should be free of prejudice toward a definition by method, and he says: "Steel of commerce is that form of iron which has been produced by melting to yield a finished product which is malleable." That is, malleability must be possessed by a metal before it can be called steel.

This definition (and that which may be discovered hidden among seven pages of qualifications in Dr. HENRY M. HOWE'S last book) includes the open-hearth product which contains not more than 0.01 per cent carbon. It takes little account of ancient usage, deep rooted in metallurgical lingo, that steel is a kind of iron *which will harden*, and as far as modern research has enabled us to understand the true mechanism of hardening by heat-treatment, it is necessary that the iron be alloyed with at least a little carbon before it will harden upon quenching. It seems illogical to call the purest iron of commerce—an iron much purer than wrought iron—a steel simply because it was tapped molten from a furnace. As it comes spouting into the ladle, a casual observer could not tell it from a carbon steel, but in the ingot and forever after it can easily be distinguished.

Is it not time to permit our definitions to be illuminated by the great light of metallography? Why not recognize that steel is an alloy of iron and iron carbide? Ah, yes, you will object, but where is the dividing line; if the stuff contains 0.01 carbon is it iron or is it steel? Or is the boundary 0.025 per cent?

As a matter of fact, it is not necessary to split hairs so fine as that. In commercially pure iron all impurities total 0.05 per cent or less. On the other hand, dead soft rivet steel from the converter contains a lot of gas and a total of 0.10 per cent or more impurities found by analysis; but to bring this metal to workable form carbon must be increased to 0.08 per cent and other elements (mostly deoxidizers) to a total of 0.35 per cent or more. In other words, the purest, softest steel of commerce contains nine times as much impurity as commercially pure iron. A man with a microscope need never confuse wrought iron with either.

Steel is a malleable alloy of ferrite and cementite. The definition includes all varieties from low to highest carbons, and differentiates them neatly from cast irons and pig irons—gray cast iron contains graphite and is not malleable; while white cast iron may contain iron carbide and be free of graphite, it is not malleable; and lastly annealed cast irons may be malleable, but they contain most of the carbon as graphite. Of course steels may easily lose their malleability by quenching; on the other hand, they are malleable when cast or can be remade malleable by the proper heat-treatment. By heat-treatment the iron carbide may also be suppressed, almost seem to be destroyed, yet it may again be regenerated and always returns as cementite and not as graphite. In alloy steels the ferrite is not pure iron, but often contains most of the added element in solid solution; the cementite may also be a complex carbide —in some cases there may be more than one carbide distinguishable under the microscope. Yet the most complex alloy steel is essentially of ferrite and cementite. Nor is there any doubt that austenitic steels (such as high-manganese steels) would break up into these constituents under a correct conjunction of temperature, pressure and time.

Many adjectives may qualify the word, noting its principal impurity or alloy, its method of manufacture, its heat-treatment, its use or its maker, but essentially, "Steel is a malleable alloy of iron and iron carbide."

Readers' Views and Comments

Students at the Chemical Exposition

To the Editor of Chemical & Metallurgical Engineering

SIR:—For a number of years the Sheffield Scientific School of Yale University has given a special summer course to all engineering students. The civil engineers go to a camp, while the mechanical, electrical and metallurgical engineers visit power plants, foundries and machine shops. When the course in industrial and engineering chemistry was established at Yale, in 1919, it was arranged that students in this course should also take summer work along with other engineering groups. It was first proposed that part of their time be devoted to visiting chemical plants. This portion of the work was assigned to me. Noting that the week in which I was to have charge of this group of men coincided with the time of the Sixth National Exposition of Chemical Industries in September, 1920, I made the request that I be permitted to take my class to New York to attend the exposition, supplementing, if necessary, with plant trips in the limits of Greater New York. Prof. T. B. Johnson, director of the Sheffield Chemical Laboratory, agreed heartily with this suggestion, but felt that the exposition would be sufficient in itself. Experience has shown this to be entirely true.

After two days in New Haven given to lecture and sketching periods, the class of 1922 in industrial and engineering chemistry was brought to the exposition for three days' work, followed by a final examination. Our experience was so pleasant and so satisfactory that this visit has been made a permanency. I have recently concluded the third of these courses, devoted mainly to chemical apparatus of manufacturing size. More than sixty men have taken this course in three years. In the past two years the students have spend the entire week in New York, lectures being given in the morning and the afternoons being devoted to visits to the various booths and study of the apparatus and machinery there shown. We have been treated with the utmost consideration and courtesy both by the management and the exhibitors. In my opinion and in the opinion of the entire faculty of the department of chemistry of Yale, this plan has been an unqualified and complete success. Not only do our students gain a conception of the construction and operation of chemical apparatus but they are infinitely more benefited by the revelation of the vast scope and power of the chemical industry and by the inspiration and vision which could not possibly be gained any other way.

The wish has been expressed that other universities might take advantage of this opportunity to send their classes to the exposition as a part of the required work in chemical engineering, and the suggestion has been made that experts in each line could be induced to talk to the collected groups of students. I wish to indorse this plan and express the hope that it may be realized. I am sure that all this could be arranged. Headquarters could be established in a booth devoted to visiting university and college students. Catalogs and trade literature could be filed under proper classifications: photographs and drawings could be mounted for easy accessibility; and the various exhibits could be cross-indexed in such a way that students could find most easily all the things they needed to see. If there were groups of different advancement, proper divisions could be made, so that students seeing heavy apparatus for the first time could be taught separately from those already familiar with the basic principles of such apparatus, leaving them opportunity to study details, improvements and new developments.

A wise choice of experts, whose principal object would be instruction rather than sales talk, would give these college students a corps of teachers, authorities in their special subjects, that could not be equaled. Instead of our small group from Yale and men from Columbia and other New York institutions who now come independently, there is no reason why hundreds of students from all over the United States could not be drawn to the most instructive week of training ever given to college men.

Speaking for myself and for Yale, I am only too glad to pledge our time and efforts to such a movement.

Personally and in behalf of my students and of Yale University, I desire to express thanks and appreciation for the uniform kindness and courtesy we met on every hand, and most of all for the splendid opportunity to see and appreciate the chemical industry of the United States.

W. T. READ.

New Haven, Conn.

Black Fractures in Carbon Tool Steels

To the Editor of Chemical & Metallurgical Engineering

SIR:—In your journal for Aug. 9, 1922 (vol. 27, p. 265) Arthur W. F. Green has directed the attention of readers to an interesting phenomenon regarding black fractures sometimes observable in carbon tool steels.

The present writer considers that black fractures owe their origin to the segregation of the impurities in the ingot. According to the theory of graphitization[1] advanced by Dr. T. Murakami and myself, graphitization is not caused by the direct decomposition of cementite into ferrite and graphite, but is due to a catalytic action of carbon monoxide or dioxide.

In steel ingots, segregation is always formed in portions somewhat inside the surface, but not in their central portion, where the cooling is uniform. In square ingots, the segregation is found in the transverse section as a square zone parallel to the sectional form, its corners being rounded. During the forging of the ingot into a circular rod or a billet, the segregated portion may preserve its original form. By a prolonged heating, the graphitization takes place by the catalytic action of carbon monoxide or dioxide in portions where such gases are concentrated to a considerable extent; the oxides which are favorable for graphitization[1] are also found in these portions. Hence the graphitization begins in the segregated portion and gradually extends outward and inward, thus increasing graphitized area. If the above view be correct, black fractures can be avoided, if the segregation be absent or very slight.

[1] *Science Reports*, vol. 10 (1921), p. 273.

That black areas have never been noted except in steel after it had been annealed shows that the graphitization took place during the prolonged annealing; the spheroidization of cementite has no direct connection with the graphitization, indicating only that the heating interval was sufficiently long. Even in black areas, some cementite still remains undecomposed; this cementite, as well as some of the decomposed graphite, especially fine graphite particles, dissolves at the A_1 point in ferrite. Hence it is easily understood that thermal curves for black portions show no abnormality, and that the black portion can equally well be hardened by quenching. The fact that annealing of the quenched specimen (which was originally black) at a temperature a little below its critical point for 2 hours restores its original black fracture indicates that the cause of the graphitization—that is, the segregation—does not disappear by quenching. This is as would be expected.

The above explanations are given by way of examples, but other facts as enumerated by Mr. Green are satisfactorily explained by the above view.

Sendai, Japan. KOTARO HONDA.

A British Editor's Impressions of the United States

BY FREDERICK E. HAMER
Editor, *Chemical Age*, London

MY FRIEND the editor of *Chemical & Metallurgical Engineering* has asked me to set down some impressions of American industrial conditions gained during a stay of 4 weeks in the United States as a delegate from the Weekly Newspaper Proprietors Association of London to the Associated Business Papers, Inc., of America. It is inevitable that one's observations should be more or less superficial in such circumstances; at the same time, on the principle that the spectator sometimes sees most of the game, they may be worth recording.

UNITY OF TYPES AND SIMILARITY OF PROBLEMS

My chief and most lasting impression is one of the essential unity between the British and American types of character and of the similarity between the industrial and economic conditions and problems in both countries. An Englishman visiting the other European countries—Germany, Italy, Switzerland, France or Belgium—invariably feels, however friendly the people may be, that he is in a foreign land. Here it is entirely different. Though this is my first visit to America, I at once sank into American conditions as into a comfortable armchair, and after a little over 3 weeks I feel as much at home in New York as I do in London. The language no doubt largely explains it; that in itself is a great and vital bond. But the likeness extends to our sympathies, our moral outlook and our general point of view. It is a great comfort to feel that the foundation principles of the founders of the American republic are still the basis of national thought and policy, and while that remains I feel that America cannot go far wrong. The future of the world rests with the English-speaking race, and if America beats England in its efforts for the welfare and progress of mankind we shall applaud and never envy your success.

Economically, both countries seem to be running on almost parallel lines. Taking the chemical industry as an example, the armistice was followed by an unprecedented boom, during which money was made with astonishing facility. One result was to bring into the chemical industry large numbers of people who knew nothing about chemicals. They bought up chemicals as they bought up anything that came along because the scarcity was such that the speculator could sell anything he possessed at almost any price he cared to ask. That unhealthy condition disorganized trade, produced a false sense of prosperity and encouraged wild speculation. This stage ended with dramatic suddenness. In a moment trade came to a stop; the speculator was left with heavy stocks on hand, and the genuine trader found that instead of being able to sell anything he could sell nothing. The "slump" lasted about 18 months. It was the most severe in the history of British chemical industry. The large firms had to hold expensive organizations together. Many of them lost heavily, and I know of several instances where people had to sell their war bonds to pay income and other taxes. Now, fortunately, the depression has passed the lowest point, and a steady revival is in progress. That, in brief, is the history of chemical industry in England since the close of the war, and I gather that it is very much the history of it in America. Let us hope that for both there is a long period of prosperity ahead which will compensate for the losses and anxieties of the past.

SIMILARITY OF CONDITIONS IS GENERAL

But the similarity between English and American conditions appears to be general. The finest address I have heard in America was one by Mr. Barnes, the president of the United States Chamber of Commerce, reviewing generally the present condition of American industry. Passage after passage might have been taken bodily out of that address and if put into the mouth of our Chancellor of the Exchequer or President of the Board of Trade they would have described exactly the condition of things in England. The primary need of settling down to work as the only real remedy, the damage caused to industry by strikes and the continual fear of strikes, the unwillingness of employers to embark on new enterprises until conditions have become reasonably stable, the irritation caused by meddlesome government restrictions, and the demand of the trader for freedom to get on with his business—these were the things that Mr. Barnes emphasized, and they are exactly the things which British economists and business men like my chief, Sir Ernest Benn, have been continually emphasizing at home.

Incidentally I have been impressed with the thoughtful and rseponsible tone of the American public men I have met. If one judged of America solely from the jumpy headlines splashed all over the pages of the daily press, one might assume the American to be a particularly blatant and noisy person, having, like the seed which fell by the wayside, no depth of earth. The truth is the very opposite. Most of the speeches I have heard have been distinguished by moral earnestness and sincerity, by great analytical and penetrative thought, by a desire to go quietly to the root of the matter, and by a sense of exactitude in the use of words excelling even our own standards.

IMPORTANT ROLE OF THE TECHNICAL PRESS

This brings me to the question of the business and technical press of America. I came over to America as a delegate from the trade and technical press of London to the business press of America. I brought with me messages of greeting from a number of distinguished

journalists and public men, and nothing was more significant than their unanimity in emphasizing the important part the business press of both countries must play in getting national business once more on to sound lines. Politics here seems to be even more of a game than with us. It is a game of personalities and parties, and the daily press is largely a reflection of these conditions. The result is that business is often the sport of politics, and economic problems are handled not on sound economic principles, but with a view to catching the popular vote. There is a growing feeling with us that the genuine commercial community does not bring its proper weight to bear on national policy, and if it is to do so it must be largely through the medium of the commercial and technical press. The great journals, for example, of the McGraw-Hill Co. understand the conditions of the various industries they serve in a way the daily journal cannot pretend to do. They can ascertain and explain the bearing of legislative changes, like the substitution of a tariff for the dye embargo, with direct authority derived from first-hand acquaintance with industrial conditions. They are in a position to serve industry in a twofold sense—first, by acting as the spokesmen of commercial interests, and second, by informing legislators and public officials on questions about which they must otherwise remain ill-instructed. The commercial and technical press of America is a magnificent instrument for the service of American industry. It has already attained an influence and reputation extremely creditable to itself, and I am impressed by the extent to which it is used, both technically and commercially, by the great industries it serves. It has, however, not reached the limits yet. My impression is that it has a still larger mission, not only in educating the industries themselves and spurring them on to the very best commercial and technological methods but equally in educating the government in relation to industry and seeing that public legislation and regulations are based on a sound knowledge of industrial conditions.

Finds Americans Interested in British Affairs

One word more. It is pleasant to find how keen over here is the interest in British politics and trade. That does not support the theory that America has no interest in Europe. On the contrary, everywhere I go the inquiry has been, What is the future of Lloyd George? What is the present position of English political parties? What are England's economic and industrial problems and how is she going to face them? In spite of themselves Americans are interested in England and in Europe. Morally they cannot afford to live to themselves, even if that were commercially possible. America, as a land built on the principles of liberty and equal justice for all, has a moral duty to civilization which it cannot ignore without damage to its own moral fiber. I have formed the impression that the real wealth of America lies, not in its gold, but in its deep human sentiment and in its sense of the moral side of life. It is in these fundamentals that the essential unity of the English-speaking peoples come out. We in England speak but little perhaps of Anglo-American unity because with us it is so natural and inevitable that it does not need to be put into words. But it is good sometimes to give expression to what is in the hearts of both peoples, and I believe that the interchange of visits and ideas is equally good for both nations, and is good for the whole world. I shall carry back with me lasting memories of American hospitality and kindness, and the impression that, underneath our external divergences, there is a unity of mind and soul that must never be severed.

Chloride Volatilization

Notices of work done by the Bureau of Mines on chloridizing volatilization of complex ores have appeared from time to time in these columns. The process consists, in general, of calcining a mixture of ore and calcium chloride in a rotary kiln, whereupon metallic chlorides fume away, being recovered by a Cottrell treater. Values are then extracted from the fume (with recovery of the chlorine) by a simple melting with a limestone flux.

For several years the chemistry of the process has been under investigation at the Berkeley station. The vapor pressure of lead chloride and of silver chloride has been measured. In connection with the formation of silver chloride vapors in the furnace atmosphere it was necessary to study the hydrolytic dissociation of silver chloride and the necessary concentration of hydrochloric acid and chlorine to prevent this dissociation. Similar work is contemplated for the chlorides of zinc and copper as well as for sodium chloride. With a knowledge of the vapor pressures of the various chlorides it will be possible to gain an idea of the ease of formation of such chlorides in a furnace, and a study of the hydrolysis of these chlorides will give data as to the necessary furnace atmosphere in order to chloridize compounds of the metals involved.

During the original investigations at Salt Lake City, an excessive loss of copper and chlorine was noted when smelting the recovered fume, especially from copper ores. Experiments are now under way at the Seattle station of the Bureau of Mines, looking toward the design and construction of an electrical furnace for this duty, expecting it will not cause the losses which occur in fuel-fired furnaces. Experiments have also shown that the latter will not fume excessively if operated at less than 1,150 deg. C. and the fume introduced below the slag line.

Many valuable data on the commercial aspects of the process have been collected by observation of the operation of a volatilization plant at the Yellow Pine Mining Co.'s property, at Goodsprings, Nev. Some experiments were carried on at a plant in Harbor City, Calif., and a high-grade zinc oxide was manufactured direct from zinc carbonate ores. The volatilization tests on ores carrying less than one-half of 1 per cent lead gave complete volatilization of the lead. The results of the tests indicate that volatilization would free the zinc ores of sufficient lead content to make a commercial zinc oxide usable for all purposes other than for making automobile tires. (Zinc oxide for making automobile tires must contain less than one-half of 1 per cent lead.) The experiments proved satisfactory, a company is now being organized to construct a larger and more up-to-date plant to commercialize the process.

A great many experiments have been conducted on different low-grade and complete ores from Utah and other states. Practically complete extractions of lead and copper have been obtained, and the extraction of silver has been from 50 to 90 per cent. Most of the experiments were confined to complex and carbonate ores. It has been found that copper ore carrying its principal value in the form of chrysocolla is very difficult to volatilize.

European Conditions as I Saw Them*

Industrial Status of Belgium and Extent to Which She Is Suffering From German Competition—Comparative Transportation and Food Costs in Belgium and Germany Show the Abnormality of Conditions in Germany—Belgian Market for American Products

By J. S. Negru

IN RELATING impressions gathered through a series of interviews with industrial leaders, economists, labor leaders and the common people, it is not to be expected that one shall speak as authoritatively as if in possession of written proof of his statements. This is particularly true when, as is frequently the case, the opinions of those interviewed are diametrically opposed to one another. Similarly, visits to plants when limited to a few hours per plant seldom furnish material on which to base unquestionable statements. Such visits usually develop into mere sightseeing tours that may be interesting to those who have never seen similar plants before, but which, as a rule, become boresome to engineers familiar with more modern installations.

Factors Considered Before Reaching Conclusions

During my trip through Belgium I tried to follow a course with respect to interviews and plant visits that would give me a happy medium of results. Thus in my interviews I gave due consideration to everyone's point of view and opinion, but seasoned it later with my own personal deductions. When visiting Belgian plants I kept in mind the very important fact that, whereas in America labor-saving devices are a *sine qua non*, similar plants in Belgium would not be so equipped, due largely to labor conditions. In America, for example, there is a larger floating untrained class of workmen, whereas in Belgium it is possible to employ steadily a group of men with long years of training in their particular lines of work. Another factor considered in reaching my conclusions was that mass production is not yet, and never may be, as pre-eminent in Belgian industry as it is in American industry.

Status of Belgium Before and Shortly After the War

With these considerations in mind, the reader will get a clearer idea of the impressions I carried away after my trip through Belgium. This is a country with a population of nearly 8,000,000, on an area of about 11,800 square miles. The principal and practically the only valuable natural resources are a very industrious population and coal that can be mined only at the rate of 22,000,000 tons per year. From this it will be clear that the country has always had to depend on export business for its daily existence, and apparently always must so depend.

When the war came on and Belgium was invaded, the coal-mining industry alone was continued under pre-war conditions. All of the other industries suffered in a greater or less degree due to the lack of raw material and a lack of facilities for export. Another factor that seriously affected the Belgian industries was the policy of the invading army of forcibly employing a number of Belgians in war work for the enemy. When peace came, Belgian machinery of production was partly destroyed and the remainder badly disorganized. The people were still in a kind of stupor after a bad dream of over 4 years' duration. The immediate result was a transitory stagnation due to the difficulty of arriving at some practical readjustment. Then began the struggle accompanying the ever-increasing cost of needed raw materials, rapidly increasing wages, reduced hours of work, and particularly a very depressing and discouraging slowness in the resumption of their export business when confronted with German competition.

Present Status of Belgium

No doubt it would have been possible for me to collect such statistics as were available, and write with the documents at hand regarding production, imports, exports, wages, index numbers and the like. What I tried to get instead was the views of employers and employees, and some typical examples of the difficulties under which Belgian industry in general was laboring. By so doing I was in a position to draw conclusions as to the causes leading to the then existing situation in Belgium.

With few exceptions Belgian plants are working with machinery similar to that of pre-war times, but the status of employees has undergone quite radical changes. I learned from Mr. B., a Belgian labor leader, that the stand taken by him and his followers is something like this: "During 1920 and part of 1921 the employers grew fat; now it is the employees' turn." This summarizes clearly, I think, the existing friction between employers and employees.

The relatively high wages, averaging, say, $2, as compared with 60 cents in Germany[1], and a stringent application of the 8-hour law have made the fight for the resumption of exports almost an impossible task. The principal exceptions are for those commodities which it was a physical impossibility for Germany to supply due to the fact that she was crowded with previous orders.[2]

Extent to Which Belgium Is Suffering From German Competition

The great extent to which Belgium is suffering from German competition is well illustrated by the following incident. When I was in Aachen, Rhineland, a few miles from the Belgian boundary, early in April, I witnessed the very striking sight of hundreds of Belgian men and women carrying heavy baskets and bundles of newly bought cheap German products, which, I learned, they would sell the same evening to merchants in Belgium. In this manner a thriving business is carried on every day on a small scale with made-in-Germany pipes, cigarette holders, knives, watches, jewelry, pocketbooks,

*This is the third of a series of articles by Mr. Negru on this subject. The first appeared in the Oct. 18 issue, the second in the Oct. 25 issue.

[1]When comparing money values I will use the average exchange prevailing at the time. In round figures $1 equals 12 Belgian francs, equal to 300 German marks.

[2]In confirmation of these observations made during the latter part of March, I may cite the following paragraph from the *Bergwerk Zeitung* of Essen published in the New York *Times* for Sept. 10, 1922: "It is characteristic of the situation that a large concern was not in a position to deliver in time to the factory the sheet iron required for the manufacture of trams for its own mines, although these trams were urgently required. The requirements of the mines for trams has greatly increased. The factories in question are fully occupied until February."

stationery and the like, all being commodities that require large amounts of hand labor. Belgian customs men were very lenient with this class of "importers." Similar traffic on a trainload scale is the rule.

Discrepancy Between Buying and Selling Prices

In order to give an idea of the great discrepancy between the buying and selling prices of commodities thus imported into Belgium, I will cite a few examples from my personal experience. A pipe bought in Germany for 40 marks sold in Belgium for 8 francs, respectively about 13 and 70 cents; a cigarette holder of material looking like Bakelite which sold in Brussels at 1.75 francs could be bought for 8.50 marks at the Tietz department stores in Berlin, respectively about 15 and 2.8 cents; an umbrella bought in Aachen for 380 marks was for sale in Belgium at 40 francs, respectively about $1.30 and $3.30; a pocketbook which in a Berlin store cost 125 marks was for sale at the Brussels Grand Bazaar for 22 francs, respectively 40 cents and $1.85. These comparisons could be continued indefinitely for practically all of the supplies constituting the great bulk of wares sold in the Belgian bazaars and department stores.

With machinery and apparatus it is quite the same. Both Mr. P. and Mr. S., contracting engineers, answered my question as to where they obtained their electrical and other supplies with the very suggestive, "En Bochie" (in Germany).

Is it then to be wondered at that Belgian domestic industry suffers so very severely from German competition?

Neither the German workingman nor the German manufacturer profits from this superdumping policy. On the other hand, a few middlemen and merchants are rapidly growing rich at the expense of German labor to the detriment of the Belgian workingman and merchant.

The extent to which Belgium relies on German-made goods is well illustrated by a short news item published in *La Gazette* of Brussels, April 14, 1922. It has its amusing side, but it is very suggestive of the practical difficulties confronting Belgium in the recovery of her industrial life. I give a translation:

> Last Sunday a flag was presented at Mons to the Amicale des Sous-Officiers Anciens Combattants [Society of Veteran Non-Commissioned Officers]. On the occasion of this patriotic demonstration illustrated postal cards were sold for the benefit of the war invalids.
>
> We have on hand one of these postal cards. It represents the Arcade of the Cinquantenaire.[3] Under the French text one can read: "Brussel, Die Arkade des 50 jährigen Jubiläums."
>
> On the address side there is a brief description of the arcade, but in German only.
>
> Germans furnishing illustrated postal cards for Belgian patriotic demonstrations! You recognize them there.

Comparative Transportation Costs in Belgium and Germany

The cost of railroad and street car transportation in Belgium deserves attention in comparison with similar costs in Germany.

The shortage of coal is far more acute in Germany than it ever was in Belgium, yet the cost of transportation by railroad and street car is, respectively, about one-fifth and one-third what it is in Belgium. Thus the fares from Hamburg to Cologne and from Cologne to Brussels for similar comforts were, respectively, $2.60 and $5.30, although the distance as the crow flies between each two points is about as 2 is to 1. The uniform street car fare in Germany was 3 marks, say 1 cent, while in Brussels the fare varies with the distance, the minimum in the so-called second-class compartments being 0.25 franc, or over 2 cents.

Is this not a clear indication of the reason for such great deficits in the operation of German transportation systems, even when taking into consideration the very low average wages of German employees, about 50 cents per day as compared to about $1.70 in Belgium?

Comparative Food Costs in Belgium and Germany

In like manner it might be interesting to give an insight into the difference in the cost of food in the two countries.

It would be confusing to take restaurant prices, as they vary with the class of restaurant. I will consider, therefore, the prices in the dining cars of railroads of the respective countries, as these are officially fixed for table d'hôte meals. The cost is about two and a half times higher in Belgium, although the German meal is perhaps the more generous of the two. As to the cost of food in homes, I learned from conversations with ordinary citizens of the laboring class that it is about four times higher in Belgium than in Germany.

From my own experience I know that in pre-war times the average living costs in Germany and Belgium were in proportion of 1 mark (25 cents) to 1 franc (20 cents). The present conditions become more striking when it is realized that Germany must import even more now than before the war.

Does it not follow logically from these figures that the cheap living for Germans in Germany on their minimum-for-existence wages is utterly abnormal, especially when we consider that the intrinsic value of German products is now even somewhat higher than it was before the war?

Research in Germany

To some it may seem beside the mark that I should dwell on these matters when I might have been looking for information regarding research and technical processes in Germany, but in my judgment these facts and figures show that people living under such conditions have little, if any, opportunity for scientific research and for changes that are not absolutely necessary.

I can assure my readers that research and experiments on how to make ends meet with the present wages are conspicuously and steadily carried out by the wives of scientists in these countries.

Fallacy of Statistics on American Imports From Belgium

During a conversation with Louis Strauss, representative in the Belgian Chamber of Deputies, Alderman and for many years in charge of the harbor of Antwerp, I brought up the subject of Belgian exports to America. I explained that our Monthly Summary of Foreign Commerce of the United States gave, under the heading "Imports from Belgium," figures which appeared to be quite important, whereas it was my impression from what I had seen and learned that they represented business far beyond what Belgium really was doing. Mr. Strauss then explained to me that the figures given in these reports represents merely the

[3] The arch in Brussels commemorating the fiftieth anniversary of the independence of Belgium.

products reaching America via Antwerp without due consideration of their original source, and that the greater part of the products classified as Belgian is in reality foreign. Most of them come from Germany and are merely shipped through Belgium. This fact has to be kept in mind when studying such figures.

Policy of Selling Below Cost

When I was in Düsseldorf I learned from Mr. H. some facts that gave me the impression that certain Belgian metallurgical plants are selling for export at prices below cost. When I was again in Belgium a few days later I succeeded in getting some very reliable data that fully corroborated my first impressions.

It will suffice to mention the case of the Providence Company of Charleroi, which underbid the Germans for 5,000 tons of rails for Bulgaria. The bid was 368.5 francs per ton c.i.f. Bourgas, Bulgaria, which represents 314 francs per ton at the plant. At the same time the quoted price in Belgium was between 400 and 425 francs per ton. The explanation given to me was that the Belgian metallurgical industry was forced into this emergency policy in order to avoid shutting down the plants.

In order to learn how the Belgian metallurgical workers looked upon this policy of selling below cost, I interviewed Mr. Baeck, general secretary of the Syndicate of the Belgian Metallurgical Workers. From my conversation I gathered the impression that the workmen give practically no thought to the economic conditions that force their employers to adopt a policy of selling below cost. He summarized the situation by saying briefly, "Ca, c'est leur affaire" (it's their business).

I left Belgium under the impression that industry there is recuperating quite rapidly. This is due not so much to the recent reduction in wages, which are now about $1.70 per day of 8 hours, but to the inability of the Germans to continue much longer their abnormally low cost of production and their superdumping selling price. These conditions make Belgian products accessible in foreign markets and will tend to stimulate local industry. Fortunately, the Belgian experience of selling for export at prices below cost was short lived.

Belgian Market for American Products

Practically all those with whom I spoke regarding opportunities in Belgium for the sale of American products stated that there is a big field for American labor-saving machinery and apparatus and other products, but that present prices are beyond their reach.

With reference to the cost of American products in Belgium, I had a few experiences that led me to the conclusion that one reason why American products are beyond the reach of the average Belgian is plain profiteering by Belgian merchants. As an illustration I may cite the case of a well-known pencil which sells in America for $1 but which was selling in Brussels and other Belgian cities at a fixed price of 25 francs, then about $2.15. From a conversation with Mr. N. of the Musée Commercial in Brussels I learned that the tariff cannot be held responsible for this discrepancy in prices, nor can the cost of transportation be held to blame. In the store where I bought one of these pencils it was explained to me that the price was fixed in the American office, but that does not seem well founded.

I am under the impression that Belgian representatives of American firms are charging for American-made goods as much as the traffic will stand. This may appeal to some as good business, but in reality it keeps the market opportunities within very narrow limits and creates the wrong impression that good American products cannot be had at reasonable prices even in a country with depreciated money such as Belgium.

This and other similar incidents were the subject of an interview with the European representative of a large American electrical manufacturing company, from whom I learned that many American firms are quite satisfied to be represented in Europe solely by natives, and give very little thought to the need of exercising some kind of supervision over the policies adopted by these representatives.

There is a great market in Belgium for American products, especially now when they seem to appreciate the advantages of American industrial equipment. Other favorable conditions already mentioned are the slow but sure elimination of abnormal competition from Germany and the gradual recuperation of domestic industry.

A plan that I think might appeal to American manufacturers is to sell modern industrial equipment to Belgium on a basis that will permit payment to be made from increased production efficiency. I know that such a plan would appeal very favorably to the Belgian industrials, who are already beginning to feel the need of modernizing their plants.

Other articles on this subject by Mr. Negru will be published in subsequent issues.

Candelilla Wax in Mexico

Since the close of the world war production of candelilla wax has shown little life, says a report from Consul F. R. Robinson, at Saltillo, Coahuila. Recently reports have been current of a revival of interest in this line, and it is understood that European interests have gone so far as to make inquiries with the object of contracting for the local output. In former years practically the entire output went to Germany, and Europe has continued to be the best market for this commodity. In 1917 a considerable amount was shipped to the United States, and was found to be very satisfactory. The cost of the local product has advanced about 25 per cent over pre-war prices, labor and other incidental costs having increased.

From 2 to 5 years, dependent upon the amount of rainfall, is required for the production of the candelilla weed, from which the wax is obtained. Primitive methods are still employed in Mexico, the present yield of wax being only about 2 per cent of the weed employed, but it is expected that improved methods will soon be perfected whereby 3 per cent of pure wax together with about 2 per cent of valuable resins will be obtained.

Limestone Quarry Studies

The United States Bureau of Mines has recently undertaken a study of limestone quarrying for lime manufacture, in connection with which a series of short papers on various phases of the industry will be issued. The purpose of these reports is to discuss conditions, methods and equipment, in order to permit higher efficiency and safety in the operation of the quarries. The first of these papers, Serial 2401, "Stripping Problems in Limestone Quarries of the Shenandoah Valley," by Oliver Bowles, is now available and may be obtained from the Bureau of Mines, Washington, D. C.

Atlantic City Meeting of the American Gas Association

Record Attendance and Exceptional Exhibit Combined With Numerous Papers and Committee Reports Make an Exceptional Convention—Papers on Carbonization, Coke Production and Cooling and Condensing of Gas of Greatest Engineering Interest

EDITORIAL STAFF REPORT

ANY convention which has 2,500 members and guests registered cannot help being enthusiastic. And when this large attendance is supplemented by a well-planned exhibit of wide interest to the industry and a fine program of technical papers and committee reports, there is no excuse for any one failing to have a profitable time. It is safe to assume, therefore, that with all these advantages the American Gas Association meeting at Atlantic City, Oct. 23 to 27, establishes a record for the industry.

OFFICERS AND MEETING FOR 1923

For the coming year the work of the association will be guided by the newly elected president, R. B. Brown, general manager of the Milwaukee Gas Light Co., and J. B. Klumpp, of the U. G. I. Co., Philadelphia, the newly elected vice-president. H. N. Brundage, of New York City, was re-elected treasurer, the only other elective office filled by action at this session.

For the 1923 meeting the committee reported in favor of Chicago, if adequate facilities can be arranged, or, failing that, for Atlantic City as an alternate place. There is considerable sentiment in favor of another meeting at this latter city, for the Steel Pier affords to the industry excellent facilities for exhibit of all types of manufacturing and gas-burning equipment that are of interest, as well as adequate space for convention meetings. The 1923 meeting will probably be held early in October, as there is strong sentiment, as indicated by the committee report, in favor of slightly earlier time of meeting than this year.

The Technical Section of the association for the coming year will be under the chairmanship of F. C. Weber, of the Henry L. Doherty Co., and the vice-chairmanship of H. C. Wehnert, of St. Louis. It is in this branch of the association that practically all the engineering and chemical work is done.

EXHIBIT FEATURES

The active interest of all branches of the industry was greatly stimulated by the splendid exhibit of gas-making, gas-distribution and gas-utilization equipment. Evidence of engineering in gas utilization was clearly shown; and the gas appliance men are evidently coming to appreciate that they must give as much attention to appliance appearance and to refinement of detail as has been characteristic of electric appliances in the past.

It is notable that at least three types of automatic control equipment for water-gas operation were on display. Several types of coke ovens were also exhibited by models in a most effective way. Other plant equipment was also shown by several dozen exhibitors.

Gas-metering devices of new types were especially conspicuous. The automatic continuous recording calorimeter of the Cutler-Hammer Co. was shown as a companion instrument to the well-known Thomas meter for measuring gas volumes. These two were accompanied by a third "B.t.u. meter" which was an indicating and continuous recording device for showing the total B.t.u. in the gas. This device is really an indicating, recording watt-hour meter producing a record of the product of B.t.u. per foot (normally measured by a continuous recording voltmeter), and the cubic feet per hour (ordinarily shown by an ammeter).

Another meter that aroused much interest among the engineers present was of the positive displacement type using the same general form of construction as the Root-type exhauster. This device, made with frictionless bearings and somewhat greater precision in other respects than the usual exhauster, was exhibited by the Connersville Blower Co. The meter on exhibit, though taking only a few square feet of floor space, was capable of handling 60,000 cu.ft. of gas per hour. As set up there it was operated by the breeze from a small desk fan directed against the inlet of the meter, showing that with 0.1 in. of water pressure the meter could be started and operated without difficulty. At maximum capacity only 0.5 in. of water pressure is required as a differential between the inlet and outlet. This device is suggested not only for station metering but also for use on industrial consumers' premises. It promises on further development to be of considerable interest in many other industries, for a meter of this simple type would probably lend itself very well to many chemical engineering problems where the metering of gas flow is one of considerable difficulty.

PRESIDENT'S AND TREASURER'S REPORTS

D. D. Barnum, of Boston, the retiring president, emphasized in his address the magnitude of the technical problems of the industry, but pointed out that these increased problems really represented increased opportunity for the industry. Adequate supply of raw material, a decreased unit charge for gas-making investment and low cost generation of the gas were problems of special importance emphasized in this address. The commercial necessity of handling much larger volumes of gas in order to meet heating loads and give good service were also stressed, as well as the usual problems of the relationship between management and employee and between the company and the public.

The report of the treasurer was received with great enthusiasm, for it showed the finances of the association to be in splendid shape and outlined extensive operations in the past and the coming year which are covered by a budget of approximately $250,000 per year. The assets of the association in securities, cash on hand and other property now exceed $100,000.

GAS DISTRIBUTION PROBLEMS

A further presentation of the "Doherty Ideal Distribution System" was made by R. G. Griswold, of the H. L. Doherty Co. He discussed in this paper the basic

principles which underlie selection of piping systems for gas distribution involving the minimum investment and the minimum annual total cost per unit of conductivity furnished. The scheme of judging proper distribution pipe size by the minimum cost per unit of conductivity per year was emphasized. Henry L. Doherty personally contributed a written discussion to this report, bringing out further the ideas upon which this system was originally based when proposed and tried out on a small scale in a number of cities some years ago. The principles discussed would be equally applicable to selection of pipe-line sizes for any other types of gas and hence they afford rather wider interest than is customary for papers dealing with city gas distribution.

Standard Pipe and Meter Sizes

Standard specifications for cast-iron pipe and specials were adopted in revised form by this convention. Full engineering details regarding these pipe sizes are given in the printed committee report already available.

The meter committee of the association took a definite stand in favor of changing meter size nomenclature. Under the new scheme proposed the case and pipe-connection sizes would be indicated by the first part of a meter size number and would correspond to the meter numbering now in vogue under the system of designation by "lights." The committee, however, proposes to add the rating in cubic feet of gas passed per hour through the meter with a standard loss in pressure between inlet and outlet. This rating would form the second part of the meter size number. Thus a meter designated as "30-600" would be one having case and pipe connections the same as an old style 30-light meter and a gas capacity of 600 cu.ft. per hour with a loss of one-half each water pressure between inlet and outlet.

Deposits in Gas Pipes and Meters

A committee on deposits in gas pipes and meters under the chairmanship of R. L. Brown, of the Bureau of Mines, reported on research done in the laboratory of the chairman of the committee. The investigation thus far shows that a number of the organic compounds such as styrene and indene, which polymerize and oxidize readily, are probably the usual gum-forming constituents of the gas. The cause of the very great increase in trouble due to gum in meters and pipes was suggested by the tentative conclusions announced. The high oxygen content in manufactured gas today, particularly carbureted water gas, is believed to be a prime factor in gum formation. The presence of excessive condensable vapor in the gas, of course, would be serious and the high rate of oil input practiced today in many water-gas plants probably gives rise to incomplete cracking of the oil and consequent production of gum-forming bodies. The committee recommends as practical preventives for the trouble (1) reducing the oxygen content of the gas to a minimum, (2) as complete condensation of gum-forming constituents in plant and holder as possible, and (3) so far as practicable prevention of the formation of these gum-making constituents by more efficient oil cracking in the carburetor of the water-gas set. The most feasible method of getting this better oil cracking is to reduce the rate of oil input into the carburetor.

Condensing and Scrubbing of Gas

Two very important articles on cooling (or "condensing," as the gas man calls it) and scrubbing of gas were presented. In an article on "The Use of the Doherty Washer-Cooler as a Water-Gas Condenser," by F. W. Steere, of Detroit, gave a very excellent report on the principles underlying washer-cooler equipment design. The principles brought out in Mr. Steere's paper are applicable in a wide variety of gas-handling equipment.

Scrubbing and condensing facilities for a coal-gas plant were discussed by J. H. Wohrley, a member of the committee on gas plant and production. Some of the more important points brought out by Mr. Wohrley's discussion are as follows:

"A desire to obtain the maximum capacity and efficiency at the smallest investment, and at the same time utilize a minimum amount of valuable space, has led to the investigation of the possibility of designing a form of apparatus which would provide for combining the condensing scrubbing, extraction of tar and removal of ammonia in a single shell or a series of shells.

"The complete scrubbing of the gas is a matter of vital importance, as it is necessary to admit a clean gas to the purification system, even though it may require that a small percentage of vapors be sacrificed to do so. The ultimate results attained will in general be more satisfactory when viewed from the financial standpoint.

"In considering the general lay-out of a system which is believed will provide for the proper cleaning of the gas, removal of the byproducts and incidentally the removal of a portion of the impurities, a diagram is given.

"The apparatus consists of a primary scrubber located ahead of the exhauster. The cooling of the gas from the foul main temperature to approximately 70 deg. F. is brought about in this scrubber.

"A curve shows the amount of heat that theoretically must be removed per 1,000 cu.ft. of crude coal gas in cooling through various ranges of temperature. From this the theoretical amount of liquor can be calculated. The degree to which the actual and theoretical amounts will agree will depend largely upon how intimately the gas is brought into contact with the saturated liquor.

"The following table shows the amount of liquor necessary and the sq.ft. of cooling coil required per 1,000 cu.ft. of gas passed for various inlet temperatures where the gas is to be cooled to 70 deg. F.:

Inlet Temp., Deg. F.	Gal. Per Min.	Sq.Ft. Coil Area
120	0.26	6.6
125	.29	7.9
130	.31	9.3
135	.34	11.1
140	.37	12.8
145	.38	14.4
150	.45	17.9
155	.51	21.6
160	.59	26.3

"The ultimate temperature to which the gas may be reduced upon leaving the primary scrubber will, of course, be limited by the temperature of the cooling water used on the cooling coils, and upon the surrounding atmospheric conditions. However, with cooling water of approximately 60 deg. F., there will be no difficulty in bringing the temperature down to 70 deg. F. This differential of 10 deg. F. should represent a maximum when proper adjustments of liquor flow and cooling water flow have been made and when due consideration has been given to the area of the cooling coil surface, the distribution of the scrubbing liquor and the design of the filling used in the shell."

Sketches show the difference in action in an ordinary

tubular condenser and that taking place in a tray-filled shell. The difficulties and advantages with the direct contact system as compared with the indirect system of cooling are fully treated in the complete paper. The different types of scrubber fillings and methods for making sprays for wetting the grids or other filling are also discussed. Results of operating tests are presented to bring out the practical results which can be expected from different kinds of equipment.

As a result of the investigation the author concludes that the washer-cooler installation permits minimum cost of maintenance and operation, has a minimum space requirement, requires no buildings except for pumping equipment, has simplest construction with no moving parts, has maximum cooling efficiency and is capable of reducing the temperature to a point most favorable for complete removal of ammonia. The results achieved with such apparatus provide for delivering only clean gas to the purifiers and for the maximum recovery of both tar and ammonia, the two important byproducts involved.

The report by Mr. Wohrley also discusses the various kinds of loss and methods of computing and controlling loss of ammonia during recovery from coal gas. The principles involved in this discussion would, of course, be equally applicable to coke-oven systems.

Accident Prevention

The committee on accident prevention had rather a full report discussing resuscitation, first-aid equipment, gas masks for plant and distribution department use, and the methods of organizing safety work. Of widest technical interest is the detailed report which forms one of the appendixes of the committee report, dealing with resuscitation from carbon monoxide asphyxiation. This report is based on an extended experimental study of treating carbon monoxide poisoning by means of oxygen plus carbon dioxide. The work was done by Dr. Yandel Henderson and Dr. H. W. Haggard, assisted by a number of collaborators and assistants.

These investigators conclude that manual artificial resuscitation by the prone pressure method should be employed whenever respiration has ceased, but that using oxygen plus carbon dioxide simultaneously aids greatly. The breathing of oxygen plus 5 per cent carbon dioxide causes very complete ventilation of the lungs and greatly accelerates elimination of carbon monoxide from the blood. There is nothing difficult about this administration and it requires no more careful supervision than any case of asphyxiation. The authors believe that this rapid elimination of carbon monoxide greatly decreases the likelihood of nervous disorders or pneumonia following carbon monoxide asphyxiation.

A separate report on masks for gas plants recommends the hose type of mask with air blower for all-around use and warns against promiscuous use of army masks and advises against depending upon the oxygen-type mask for simple work or the cannister-type unless adequate oxygen supply is known to exist. The first-aid equipment and methods of safety organization recommended are suited to general industrial plant purposes.

Carbonization Committee Report

The carbonization committee of the association presented one of the most complete and valuable reports ever given to the gas industry by any association committee. The work, as in former years, was divided in several parts, typical operating results being considered by one sub-committee, low-temperature carbonization by a second, complete gasification by a third and new types of construction by a fourth.

The committee announced that further work would be done during the coming year with an appropriation of $3,000 which has been granted for experimental research at Ohio State University, using the vertical retort installation already there and a new horizontal retort which is to be installed. The present equipment represents a single full size U.G.I. vertical. The horizontal retort to be installed is being contributed by the Improved Equipment Co., representing typical small-plant construction of a modern sort.

Typical operating results were not reported by the committee this year, because it felt that the basis of reporting had not been adequately studied formerly. The committee, therefore, gave a great deal of time to the revision of the forms on which coal carbonization results should be recorded and reported. These revised forms are given in full and are now proposed for comment and criticism, before adoption for use during the coming year by the new committee.

Operating results were reported by the committee from the plant at Racine, Wis., where "outside producers" are used. This work is similar to that presented at the 1922 convention of the Wisconsin Gas Association.

Firing Coke Ovens With Blue Gas or Producer Gas

W. R. Morris, assistant superintendent of the Seaboard Byproduct Coke Co., gave a full report on an experience at that plant using blue gas and producer gas for firing coke ovens. The results with the two fuel gases were strictly comparable, because the work had been carried out simultaneously on almost identical batteries of ovens and had extended over considerable periods of time. Full operating data are given from which the author draws the following very important conclusions:

(*a*) The overall or the gasification and combustion efficiency of producer gas is much greater than that of blue gas as shown by the following comparison:

	Producer Gas	Blue Gas
Pounds dry fuel to carbonize a ton of coal	225	295
Pounds of carbon to carbonize a ton of coal	199	261

In other words, only 76.3 per cent as much fuel is required with producer gas as blue gas to carbonize coal.

(*b*) Poorer and less salable grades of coke can be more readily used in a producer plant.

(*c*) Producer operation requires much less labor per ton of fuel gasified.

Since the collection of the operating data given above, we have put through our six producers for a period of 3 weeks almost 300 tons of coke per day, or from 45 to 50 tons per producer per day without any appreciable difficulty and no addition of labor.

Carbonizing 50 tons per day per producer and 50 tons per day per blue gas generator the labor is:

Producer 0.51 man-hours per ton gasified;
Blue gas 1.50 man-hours per ton gasified.

In the entire producer plant there is required no labor whatever of the particularly heavy or arduous type, while no one questions the strenuous task of clinkering a water-gas generator.

(*d*) Continuity of operation of a producer plant is such that the machines run for weeks and months at a time with no attention other than watching that the conditions set are regularly maintained. The possible mechanical derangements are a minimum. This must appeal particularly to the water-gas man, familiar as he is with the intermittent operation required with a water-gas generator.

(*e*) Mixing the blue gas and producer gas with coal gas for the purpose of obtaining a specified B.t.u. can be done with equal ease.

(*f*) The manufacturing cost of blue gas per million B.t.u. is fully 40 per cent greater than producer gas. This cost is based on the same value for generator fuel in each case, which is decidedly unfair to producer gas as it uses inferior and therefore cheaper grades of coke.

Conclusions—As a part of a large byproduct plant furnishing gas for city use a blue-gas plant has advantages over a producer plant in times of coal shortages, caused by strikes or other contingencies beyond the control of the manufacturer. Also in a business depression, when the market for coke is poor and prices low, a blue-gas plant is desirable because more blue gas than producer gas can be mixed with the coal gas, which also means that a greater percentage of coke can be turned into gas.

However, for anything like a steady operation a producer plant is a far better proposition:

First, because of its greater efficiency in changing heat units in the form of carbon to a combustible gas.

Second, because of the simplicity and ease of operation.

Third, because of the far lower manufacturing cost.

Low-Temperature Carbonization

The sub-committee on this subject reported by means of three technical papers. The first, by J. D. Davis, of the Bureau of Mines, who was chairman of the sub-committee, discussed "Low-Temperature Tar and Its Evaluation." Two of the important conclusions reached by this author are as follows:

Low-temperature tar may vary considerably as regards yield and character of its constituents, depending on the conditions under which it has been generated. If, for example, it is desired to produce a tar in which the constituents have suffered the least alteration, it is necessary to carbonize at the lowest practicable temperatures and to remove the tar vapors quickly from the heated retort, either by evacuating or by circulating inert gases. This procedure reduces the gas yield to a minimum and results in the production of an inferior semi-coke. Tars generated at intermediate temperatures and distilled at atmospheric pressure undergo more or less thermal decomposition, with the result that the gas yield rises and a coke dense enough for domestic use is produced.

In the United States it may pay to develop a low-temperature carbonization industry primarily for the production of a domestic fuel with motor spirit as a liquid byproduct. Certainly such an industry would effect a conservation of our fuel resources and tend toward abatement of the smoke nuisance caused by the domestic consumption of soft coal. It would not greatly affect present established carbonization industries. Another possibility is complete gasification of bituminous coal with preliminary carbonization at low temperatures, the tar to be worked up primarily for motor spirit. In any case, the main tar product will probably be motor spirit, and low-temperature tars should be evaluated with this idea in view.

Internal and External Heating of Retorts

The second paper presented by this sub-committee was by Charles V. McIntyre, of New York City, who discussed "Internally Heated Retorts." Problems and processes for internal heating with producer gas, water gas, coal gas, superheated steam and products of combustion were all presented. The author gives the impression that the most encouraging of these processes are those which contemplate the use of water gas as the medium of heat transfer. Of course, such method really results in a complete gasification process or some near approach to that result.

Internal heating of retorts must be done at extremely low temperature to prevent the coal from becoming plastic or the retort must be equipped with mechanical stirring devices. As a result internal heating of retorts results in producing a char instead of a coke. This material is granular and dusty and suitable, in general, only for grinding into powdered fuel for stokers or for briquetting or for use in producer-gas or water-gas making. The author concludes that "the most successful internally heated processes operate in conjunction with, and deliver their entire residue to, gas producers or water-gas generators.

External heating of retorts for low-temperature carbonization was discussed by Dr. Harry A. Curtis, of the Clinchfield Carbocoal Corporation, who gave special attention to the problem of transferring heat to the coal mass through the retort body. As a very complete discussion of this general subject has been prepared by Dr. Curtis for publication in *Chem. & Met.* at an early date, no further discussion is required here.

Complete Gasification of Coal

The sub-committee discussing complete gasification reported through its chairman, R. G. Porter, of Chester, Pa., regarding a number of the fundamental problems of city gas supply using very lean gases. Emphasis was laid upon service problems involved with such gas and the possibilities of house heating and other extension of gas service for replacement of solid fuel. As appendixes to the report there are given descriptions of a number of the successful processes for complete gasification that have been used for short periods in a few localities. These descriptions include the Tully gas plant, the J. U. McDonald process as applied at Valparaiso, Ind., and the Doherty complete gasification plant at Toledo, Ohio.

New Gas-Plant Construction

The builder's section of the committee furnished a number of brief reports on new types of gas plant construction and new plant machinery. This group of reports included a description of the Roberts oven, by H. V. Patterson; a description of charging and discharging machines of the Bartlett-Heyward type, by H. L. Underhill; carbonization apparatus of the Gas Machinery Co., by W. E. Steinwedell; continuous type Glover-West vertical retorts, by E. G. Blackwell; new type Koppers oven, by H. J. Rose; the new carbonization plant built by the Russell Engineering Co. at Lowell, Mass., by Vernon Baker; the new Semet-Solvay byproduct coke and gas ovens, by C. R. Bellamy; and further details on the U. G. I. Contracting Co. installations of vertical retorts, by J. H. Taussig. Mr. Taussig is chairman of this sectional committee.

Preparation and Merchandising of Coke

W. G. Rich discussed the commercial problems in merchandising coke, giving as illustrations of the methods discussed a full report on the domestic sale of coke in Providence, R. I. Special emphasis was laid on the problems of advertising the product effectively.

"The Manufacture and Preparation of Coke" was the title of an article by R. L. Fletcher, who is also connected with the Providence Gas Co. Although written from the standpoint of a gas man, the author laid great emphasis on the necessity of treating coke as a principal product, instead of merely a byproduct of gas. The preparation of coke to form a satisfactory substitute for coal, of equal or greater efficiency for general use, was shown to be an entirely feasible matter.

Mixing of coal and pulverizing the mixture were urged to produce good water-gas coke as well as high-grade domestic fuel. The methods and equipment for handling the coal for charging and the proper methods for screening and crushing of coke were described. It is especially notable that the equipment recommended

by this author for gas-works is almost exactly that commonly employed in the byproduct coke-oven plants. Problems of storage, sizing, sampling and analysis were also discussed briefly.

Availability of Papers

The Gas Association had preprinted the principal papers and committee reports, hence those specially interested can procure most of the material of greatest value by application to the association headquarters, 342 Madison Ave., New York City.

Balls Used for Hardness Testing

J. J. Curran, of the Henry Souther Engineering Co., speaking before the Detroit meeting of the American Society for Steel Treating, described some tests made on four different kinds of balls intended for use in Brinell machines. One lot of plain carbon steel was made by a foreign manufacturer, another of chromium-tungsten steel was made by the Hoover Ball-Bearing Co., and the two others were chromium steels of local manufacture.

Surface polish—an essential for durability in a ball bearing—seemed to have little to do with their utility for Brinell testing. The best balls (as it developed) had a very inferior polish. All of the balls of all varieties were measured and passed a rigid inspection for shape.

When testing by a scleroscope, mounted in a special fixture, the balls of carbon steel seemed to be hardest. When mounted three above each other and crushed, the results were so erratic that conclusions could not be drawn. Finally, two disks of Cr-W steel (ball steel) were hardened carefully, a ball placed between them, and 3,000 kg. load applied. This test was repeated on three balls of each variety, the disks being indented in a different place each time. Invariably the two indentations made simultaneously by a single ball were identical, so it appeared that the disks were of uniform and equal hardness. However, the carbon steel ball gave the smallest impression—i.e., indicated the highest hardness in the disk (approximately 700). Other varieties of balls indicated valves as low as 600. Lastly, each ball was remeasured for permanent deformation. Each one was flattened by the single test it had performed, but the flattening was least in the hardest ball (carbon steel).

From these results it seems desirable to get the hardest ball possible for use in a Brinell machine.

Evaporation Losses of Petroleum Products

In the general study of evaporation losses of crude oil and refined products, being made by the Bureau of Mines, an elaborate series of tests has been made at a Ponca City, Okla., plant to determine the relative rates of evaporation of gasoline when stored in ordinary tanks and tanks fitted with water-sealed roofs. Tests were also made to determine the amount of gasoline that was lost in filling a tank car with straight-run gasoline of 56 to 58 deg. Bé. gravity. Temperature measurements are being made to determine the temperature of oil in three different types of tank—one of the ordinary 55,000-bbl. type, one an 80,000-bbl. insulated tank, and one a 55,000-bbl. insulated tank on which a water spray is used. Arrangements have been made for conducting a series of tests to determine evaporation losses at an Okmulgee, Okla., refinery.

A Practical Method for Preventing Explosions Due to Accumulations of Static Electricity

By Hilton Ira Jones
Director of Research, The Redpath Bureau

IN JANUARY, 1919, we were working on the preservation and sterilization of eggs.[1] In the course of this work we employed an R.U.V. ultraviolet light outfit, and also produced enormous pressures according to the system of Hite (University of West Virginia) followed by sudden vacuums. This was accomplished by placing the eggs in an equal molecular mixture of oxygen and hydrogen gas, exploding the mixture and condensing the water vapor. In the course of this work we observed a marked change in the discharge of the Ruhmkorff coil whenever the ultraviolet machine was operating near it. Also we employed a Cenco Hyvac pump and on several occasions got the ordinary spark discharges from the belt when the machine was running, and we observed that these immediately disappeared as soon as the ultraviolet outfit was started. We have also for several years performed as a regular demonstration in general chemistry the explosion of powdered starch in an inclosed chamber. We used a sewer tile set in a cement base and covered with strong paper, tightly tied. A small amount of finely divided starch was blown in a small hole at the base. The mixture was exploded both by placing a flame at the hole and also by a spark discharge between two points within the tile. On this particular day we prepared the demonstration in the room where an X-ray was running and we were disappointed at our inability to make the explosion take place with the spark as usual.

Investigations on Cause and Prevention

During the past year we have been carrying out experiments in connection with the work of the dry cleaners, mainly in the revivification of the waste gasoline by a new process, soon to appear. An explosion of the gasoline vapor in the "tumbler" of one of the plants in the city led us to investigate the cause and possible prevention.

Our experiments and observations have led us to see that most "mill dust" explosions, gasoline "tumbler" explosions and indeed a majority of powder mill explosions are caused by sparks of static electricity. These may be prevented, at least in nearly all cases, by ionizing the air. This has the effect of causing the static to "drain off" quietly and harmlessly as fast as produced. In fact it is quite impossible to produce static or other electric spark explosions in the presence of highly ionized air.

The air may be thus protectively ionized in many different ways, by ultraviolet light, by X-ray, by radioactive substances or any other means that will cause the emission of electrons in sufficient concentration. A tube of the type of the old Crookes tube we have found best. Some glasses are much more permeable to the electrons than others. We are now taking up with the Corning Glass Co. the production of a special glass for the manufacture of a tube for the ionization of the air in factories and mills. We are hoping that these may be placed on the market soon. Appropriate patents are of course being applied for.

Chicago, Ill.

[1] *J. Ind. Eng. Chem.*, August, 1920.

Accounting Needs of Technical Men in Executive Positions

Accounting Needs Technical Balance as Much as the Technical Executive Needs Accounting—Pertinent Examples Are Discussed—Finally the Type of Accounting Knowledge Needed by the Executive and the Means of Obtaining It Are Outlined

By F. W. Thornton, C.P.A.
Price, Waterhouse & Co.

FROM articles that have already appeared in this publication, it seems that there still are executives in the chemical and metallurgical industries who believe cost accounting to be without value, at least for them. This belief is probably held by technical men with small accounting knowledge who now occupy executive positions. On the other hand, there are in all lines of industry executives who are not technical men but who have a good knowledge of accounting and who think they can prove from cost accounts many things that are not so. Both classes of executives are half wrong and half right, due to the fact that they are only half equipped for their positions.

Perhaps in no other business is the need for technical knowledge to direct cost accounting so great as in the chemical and metallurgical industries.

Executive heads if not originally technical men cannot be expected, after they have become immersed in business, to acquire a sufficiently exhaustive knowledge of the technical side of a chemical or metallurgical industry to serve them as they should be served. Executives can and generally do obtain some knowledge of the technical side of their business, but the ideal executive is one who, originally a technical man, has obtained a good knowledge of accounting and gone forward into the executive department. Nothing produces more unsatisfactory results than a strict separation of the lines of promotion of technical and non-technical men similar to the division between the line and the staff in the Army.

An Example of the Need of Technical Guidance

The history of LeBlanc soda offers one of the best examples of the need for technical guidance in cost accounting. Originally soda (soda ash or carbonate) was the only product aimed at. Hydrochloric acid was a byproduct of little value, often a waste product; salt cake was not then used in glass manufacture, so-called "sulphate" paper was not manufactured, and except as horse medicine there was little if any sale for sodium sulphate. At that time correct cost accounting would have taken as the cost of the soda ash the entire cost of manufacture less whatever was recovered for HCl or other byproducts.

Then the ammonia process came, producing better and cheaper soda; it produced no HCl; and this latter product rose in price. Eventually the LeBlanc process was continued only because of the HCl—or bleaching powder—which it produced. At this time correct cost accounting would have shown as the cost of bleaching powder the entire cost of manufacture less whatever was received for soda, which became a byproduct, or for recovered sulphur.

Finally electrolytic soda and chlorine have come; the LeBlanc process is almost dead except that the first step—the manufacture of sodium sulphate—continues, the salt cake being sold as such.

Clearly the only present reason for continuing is the production of sodium sulphate, the HCl being a byproduct. Correct cost accounting will show as the cost of the sodium sulphate the entire cost of manufacture less whatever is received for HCl or other byproducts.

"Process," Not "Product," Should Be the Cost Basis

It will be noted that a great error into which non-technical cost accountants fall is the endeavor to show separate costs for each *product*, whereas a better basis is the cost of each *process*. In the issue of Aug. 16 there is pointed out (page 296) an absurd result that could be arrived at by the application of doctrinaire cost accounting—namely, a profit on Na_2SO_4 with a concurrent loss on HCl, and as a result the suggestion that the business be pushed in salt cake but not in HCl. We can go much further with process costs. The product is Na_2SO_4 plus HCl, and assuming for illustration that the salable forms were (Na_2SO_4, $6H_2O$) and aqueous acid containing 19 per cent HCl, the output of each will be, approximately, in the ratio of 1 lb. salt cake to 1½ lb. hydrochloric acid. The cost account should show as the unit of cost 1 lb. salt cake plus 1½ lb. hydrochloric acid, whereupon the possible selling price of the sodium sulphate could readily be computed by deducting from the unit cost the current market value of 1½ lb. hydrochloric acid, then adding profit expected. Much mental discomfort awaits the cost accountant who attempts to show separate costs for joint products.

What Is a "Process" for Cost Accounting Purposes?

But if the process were to be continued further, the HCl converted into hydrochlorite and salt cake into soda ash, what should be done?

In speaking above of the "process" as the basis of a cost account, it is considered that for this purpose a "process" is complete when a freely marketable commodity is arrived at. The object of every cost account should be to show whether the manufacturer is making (1) a profit, (2) how much profit, (3) the greatest possible profit.

In the case under consideration, we have arrived at a point where we have two readily salable products with current market prices easily ascertainable; then if the products are to be used as the raw material for bleaching powder and soda ash, the first process of manufacture should be credited with the salt cake and HCl at the current market prices; for if the succeeding processes cannot make a profit on this basis, it would pay better to sell the salt cake and HCl as such; a transfer at any other price would hide the truth. If, for instance, the salt cake were transferred to the next

process at cost, the manufacture of soda ash might show a profit, which might be correct. But it would not show whether the greatest possible profit had been obtained. If it had been charged with sodium sulphate at the price that could be got in open market and had then made a profit, it would be evident that the conversion had paid.

Some cost accountants would say this was "not fair to the HCl." Not fair! Then have chemicals rights not only independent of but contrary to the interests of their owners?

During all this time a person with an excellent knowledge of cost accounting but no knowledge of chemistry would have produced cost accounts that could only be called silly, and a chemist without any knowledge of cost accounting would have done no better.

Technical Judgment Essential in Considering Obsolescence and Depreciation

It is to be noted that there are spoken of above only those periods when changes of trade conditions had arrived at a definite stage; there were, in between, periods when the ammonia process was making slow headway and when the electrolytic process was not an assured success. It is precisely during such periods of changing conditions that there is most need for the technical man to direct the cost accountant, having in view probable early obsolescence of plant.

The questions of depreciation and obsolescence also call for much technical knowledge. The bookish cost accountant often holds that the "only correct" method is, say, the setting aside of a percentage of cost—or of diminishing value—or a rate per unit of product, etc. This is mere foolishness. Again it may be repeated that cost accounting is useful only to show what profits are or can be made. Some assets have a life that can be computed within reasonable limits and give substantially 100 per cent service during that life—a steam boiler, for example. Others may have a relatively indefinite life, subject to frequent repair or with a gradually increasing inefficiency.

Freight steamships have a life, generally speaking, of about 20 years; they are usually depreciated at 5 per cent of cost each year; they become somewhat more troublesome and inefficient as they age. At first sight it would seem that the rate for the first years is too low, but here a factor enters that is too often ignored—namely, the interest on the capital absorbed. Thus, for a ship costing $1,000,000 the real carrying and depreciation cost for the first year is 5 per cent on investment plus 5 per cent depreciation—in all $100,000. At the end of 10 years the cost is 5 per cent on investment (now reduced to $500,000) plus 5 per cent depreciation —in all $75,000. It is because of this drop in interest on investment that plants long in use, with the average of all items half worn out, are valued usually at more than half the replacement cost. The interest on investment does not and should not appear in the books.

Where a plant gives increasingly inefficient service as it becomes older, the need for high depreciation rates during the period of high efficiency becomes greater; if 100 per cent service is given during the entire life of plant, the distribution of its cost equally over its whole life rather favors the later periods when the invested value has become reduced. Common sense must decide, not arbitrary rules.

Precisely similar conditions are presented in chemical and metallurgical industries. A simple knowledge of how long a tank furnace making glass will live, without a knowledge of its increasing demand for roof repair as it grows older, will not enable a cost accountant to depreciate it properly; and who but a technical man could say how much more rapidly it would wear out if a change were made to use a new sand containing, say, 2 per cent more Al_2O_3, with perhaps 100 deg. increase of temperature?

Flexibility of Cost System With Changes in Process

Suppose that at this moment the ammonia soda process should be so changed that at small extra expense the HCl were obtained free. What would be the cost of that HCl? Surely not the amount of the additional manufacturing cost, for such a change would certainly bring about a drop in the price of soda. Then the cost of the HCl would be the additional expense plus the loss on the price of soda. Who could separate the amount of that loss? Cost accounts dealing with the process, not with each product, solve the difficulty.

The distribution of joint costs, burden and other expenses is simplified by the substitution of process costs for costs of each product. There are also cases where a group of joint products may partly be varied at the will of the chemist; a byproduct might be either ethyl alcohol or acetic acid, as he chose. A knowledge of what can be produced and the relative cost of production for alternative products, and the selling prices, all enter into the problem of the best selection of processes. The chemist must be an accountant or the accountant a chemist to meet such situations.

All this is now recognized to such an extent that the student who is preparing for a career as chemist or metallurgist usually takes some accounting course, and we may leave the colleges to deal with him. But no reasonably adequate provision has been made for the men who have gone far in technical work and are in line for executive positions but are without the accounting knowledge that an executive must have, nor for technical men who are so responsible for profitable operation that they must, to some extent at least, supervise and check the cost accounting of their departments.

To suggest that they go back to school and take a regular course in accounting may be a counsel of perfection—it is impractical. Such men already have developed an intelligence that should make it needless to go through the drudgery of learning bookkeeping, etc., in the ordinary way; it is not necessary for an executive to know all the details of bookkeeping. They should, indeed, understand the general principles of books—the old simple theory of ledger, cashbook and journal—and should understand cost accounts. They *must* be able to read and understand operating statements, profit and loss accounts, and balance sheets, and must be able to interpret them so as to get from them all the information they can give as to the progress of the business.

Where changes of process, raw materials or machinery occur, it is easy enough to find whether, and how much, a department has increased its profit; but in addition to the specific change there are constant other changes that affect profits, such as variations in water and coal supply, hours of labor, disposition of employees —and the executive head should be able so to dissect and analyze operating statements as to determine the effect of any given factor.

The course of study for technical men of experience should, therefore, be individual and not class study. The instruction of a really able accountant, if possible one with some technical knowledge or a public accountant

with experience in chemical or metallurgical work, should be obtained. An elementary knowledge of simple bookkeeping is assumed—almost every educated man has it. Then the course of study may well be similar to that outlined below.

First the student should take up "process" cost accounting. This is the simplest and most satisfactory form of cost accounts. "Job" costing may well be omitted, as it is not of much use in either chemical or metallurgical work, is far more difficult to master and is less satisfactory under the best conditions.

"Process" costing is that species of cost accounting that deals with the continuous manufacture of a product —such, for instance, as the manufacture of glycerine, of beer, or raw photographic film, of pig iron. "Job" costing deals with the production either of single large units, such as locomotives, ships, pianos or with the manufacture in batches of smaller articles, such as manicure sets (in lots of, say, 10,000) watches, scientific instruments, machines.

Generally, chemicals, metals, alloys, glass and all bulk products are covered by process costing, while elaborating processes resulting in finished articles are usually covered by "job" costing. Continuous production of small articles in great numbers may be the subject of process costing. Single lots of special chemicals may be the subject of job costing.

It will not be necessary for the student to take all his examples of process costing from his own business; there is such a family resemblance between process costs of all trades that benefit will be had if costs of other trades are studied. It will even tend to enlarge the student's knowledge of the resources of process costing methods beyond what could be got from consideration of the accounts of his own industry.

Operating Reports, Profit and Loss Accounts and Balance Sheets

Then, to fit the technical man for the highest executive positions, he should make a study of a series of operating reports, profit and loss accounts, and balance sheets, all preferably of the enterprise with which he is connected and if possible bearing notes of changes in methods, processes, etc., with dates of introduction of the changes. First he should compare the successive reports, trace the results of changes, trace the results shown in daily or weekly operating statements to the profit and loss accounts, and trace the effect on the balance sheet of the profits and losses shown. All this should first be done alone. Then the teacher should go over the same matter, the student noting the conclusions drawn by the teacher and, most particularly, the teacher's reasoning on which those conclusions are based. The student need not accept either the reasoning or the conclusions; that is immaterial, as the object of the study is to acquire the working tools of accounting.

Suppose you have certain plant that has become obsolete; it can be used to produce a certain article, but is otherwise valueless. Assume further that the article can be produced and sold at a profit provided that nothing is charged for depreciation of the plant. Many doctrinaire cost accountants insist that full depreciation be charged to cost, showing a net loss less in amount than the depreciation charged. Such cost accounts, showing a loss in operation, would lead to the abandonment of the work, although the owners would be better off to continue it while the old plant lasted, using all profit in the amortization of the old plant. The remaining loss on the plant should be taken up separately. Much contention is avoided by making up cost accounts showing, first, cost before depreciation and obsolescence, then the provision for these purposes, and finally cost including depreciation and obsolescence. You can even add to cost an amount representing interest on capital, although that is by no means recommended. As Mark Twain has it, "First get your facts and then you can distort them as much as you please."

No Special Literature Needed for Chemical Accounting

The literature of cost accounting is not lacking in correctness, volume or variety, the problems of the chemical and metallurgical industries are those of other industries with such modifications as local conditions may indicate. A competent technical man with an accounting education that had not been in any way directed to the special work of his industry would have no difficulty whatever in adapting his accounting knowledge to his needs. There is an accounting variation between individual enterprises within these industries far greater than the variation between the industries as a whole and other lines of business. One company makes a thousand and fifty-seven varieties of chemicals and drugs, from sirup of squills to kakodyl cyanide, and has thousands of small customers, while another confines itself to the production of acid phosphate manure and sells its entire product to one other company. No special literature for chemical or metallurgical accounting seems to be needed.

In studying profit and loss accounts and balance sheets, particular attention should be given to the burden of excessive inventories, of idle capital caused by plant not in use, of excessive deterioration of plant due to corrosive materials handled, and the loss of operating time due to repairs. All these considerations are of a character that cannot be fully understood and correctly dealt with either by the accountant alone or the chemist alone. After making a study of such reports and accounts as are available from the enterprise in which the technical man is engaged, there should be obtained similar series of balance sheets and profit and loss accounts from other businesses, preferably businesses where the history of changes is known to the teacher and the accounts have been published so that they are no longer private in character; these should be worked over as outlined above.

A course of this kind will be found deeply interesting and will give the intelligent technical man a working knowledge of accounts in far less time than such a knowledge could be acquired in any other way. It will cover exactly the ground that in an executive capacity he may be called upon to cover.

Finally, to the advanced technical man some advice may be given that could scarcely be given safely to a young student; do not permit yourself to imbibe from any teacher the idea that any form of cost or other accounts is the only correct one, or that any statement or cost account that brings out clearly the facts is in contravention of the "true principles of accounting." As the greatest accountant of them all has said, There is but one true principle of accounting and that is to make accounts up in such a way as to show with the greatest clearness possible all the facts. Let your teacher have his way, but in your own mind remember that you are arming yourself with the tools of accounting and afterward will do with them whatever you think right.

Tests on High-Tin Bearing Metals

High-Speed Gas Engines Require Bearings of Highest Quality—General Remarks on Chemical Composition and Microstructure of Suitable Alloys — Detailed Directions for Casting in Bronze Shells—A Series of Commercial Alloys Were Tested for Hardness, Compressive Strength, and Coefficient of Friction — Bearings Were Also Run Dry Until Destroyed

By P. W. Priestley

ANTI-FRICTION bearing metals do not appear to have received the attention of investigators which they deserve. In view of the large quantities employed in the automotive industry alone, it is surprising to find that very little information is available which is of direct value to the engineer in the selection of white metal bearing alloys. Recently a number of investigations have been made by eminent workers and the data now on record form an admirable help in proceeding to examine the mechanical properties of these alloys.

It appears urgently necessary to establish a commercial form of test (applied particularly to durability and wearing properties). The test might directly indicate a definite unit property, or alternatively a formula showing relative merits between commercial mechanical tests. Service records would prove of extreme value to those concerned in the design, construction and application of machinery incorporating anti-friction bearing metals.

The following remarks apply mainly to a number of high-grade proprietary bearing metals of British origin, tin-base mixtures which have been successfully applied in high-speed internal combustion engine construction. It is hoped that serviceable information will also be found by those engaged in wider fields.

Microscopical

It is considered that the essential characteristic of a desirable alloy is to have hard grains imbedded in a relatively soft material. The function of the hard material is to resist wear and to provide a surface having a low coefficient of friction. The softer constituent permits a uniform distribution of load due to the possibility of adjustment, partly by distortion and partly by rapid wear, leaving the particles of the hard constituent in slight relief. It is further claimed that the hollowness of the softer areas assists in promoting lubrication. It is, therefore, necessary to obtain an alloy too hard to permit lateral flow and yet soft enough to adjust itself under load. Microscopical examination of a typical tin-antimony-copper alloy reveals cuboids of antimony-tin and long needle-like crystals of copper-tin forming a series of long bearing points imbedded in a matrix or cushion formed by the tin ground mass.

Chemical

Satisfactory results are obtained with the binary alloys of copper-tin, tin-antimony and lead-antimony, but the ternary alloys tin-antimony-copper, tin-lead-copper and tin-antimony-lead are better. Unfortunately the ternary alloys have not been thoroughly investigated, but it may be stated that the tin-antimony-copper mixtures are at the present stage most successful in the motor car under actual working conditions. There is little difference in the coefficient of friction of the tin-base alloys and the lead-base alloys; it is the ground mass which characterizes the two types. The lead-rich alloy is considerably weaker in compression and tension at normal working temperatures than the tin-rich alloy, and it is now generally accepted that the service to be obtained is controlled by the strength of the ground mass.

Antimony increases hardness, wearing qualities and brittleness. High casting temperatures cause heavy antimony losses.

Bismuth may be introduced to the extent of a trace in the capacity of a flux.

Copper is comparatively readily soluble in tin, and prevents segregation and increases hardness. When present in quantities exceeding approximately 5 per cent, copper promotes brittleness and a tendency to crack when used in high-speed engines. Casting temperature is increased by increasing amounts of copper, with a consequent coarsening of the structure. In alloys containing this element, rapid cooling considerably increases the hardness as compared with slowly cooled alloys.

Iron increases hardness and brittleness, and is considered an undesirable impurity.

Lead in small proportions is permissible, since its presence increases fluidity during casting. In the solidified metal lead promotes ductility and resistance to rapid changes of loading. American practice permits quantities up to 0.35 per cent, and it is present in the ground mass of the alloy, having little effect upon the melting point. English practice generally excludes this element in quantities exceeding 1 per cent. Large quantities produce a soft alloy and cheaper product, and it is possible that lubricants containing an excess of alkali will pit lead-rich mixtures. One of the alloys selected for this investigation contained approximately 20 per cent lead. The tests showed that while the metal exhibits the smallest dimensional change under compressive load (greatest Brinell hardness), it will withstand only a comparatively moderate load without cracking. This fact must materially affect lateral flow and at the same time prevent adjustment of the ground mass.

Nickel in quantities not exceeding 0.50 per cent increases ductility and removes the liability to crack without affecting the wearing qualities. In the tests to be presently described it is seen that a high-tin alloy having 0.53 per cent Ni withstood the highest compressive load without sign of cracking, but that this property was accompanied by the greatest dimensional change under load (smallest Brinell hardness) of any of the metals selected for examination.

Tin in large percentages promotes rigidity and increases wearing qualities. The cost of a bearing metal is controlled by its tin content, since this element is by far the most expensive ingredient contained in any form of anti-friction bearing alloy.

Zinc creates a tendency to seize and increases hardness and brittleness. It is possible that a detrimental action may take place in the presence of salt water or benzol when zinc is present. This element is considered

an undesirable impurity. It is interesting to note that experiments have been made in France and England with zinc base bearing metals. An alloy which has met a certain amount of favor is one containing 70 per cent zinc and 30 per cent tin. A binary series of alloys of zinc and tin will not contain the relatively hard constituents necessary, and a ternary alloy having a closer resemblance to the tin-antimony-copper mixtures under consideration is developed by the introduction of small quantities of antimony and copper. A mixture which has been utilized for relatively heavy duty contains 80 per cent zinc, 15 per cent tin and 5 per cent copper. A bearing metal of French origin introduced with the object of reducing to a minimum the use of the more expensive metals has a composition 63.3 per cent zinc, 21.3 per cent tin, 12 per cent lead and 3.3 per cent copper. In the absence of data relating to these comparatively complicated mixtures the ternary alloys maintain their established position in Great Britain.

Casting Practice

The initial preparation of the alloys, alloying procedure and handling during pouring influence the structure considerably and in turn the service attainment of any bearing mixture.

When a warm sand mold is employed, slight differences of temperature do not materially affect the structure of the tin-antimony-copper mixtures except that the arrangement of copper-tin needles is more regular than when a cold sand mold is employed.[1]

Cold metal molds or molds warmed to a temperature approximately 100 deg. C. produce a metal with chilled borders, and a rise in pouring temperature from say 300 to 400 deg. C. increases the depth of the chill. When the temperature of the mold is raised to 200 deg. C. and a casting temperature of 350 deg. C. is employed, the structure is uniform and fine grained throughout, becoming somewhat finer at the extreme edges. Brinell tests[1] indicate that chill-cast specimens are generally harder than sand-cast examples.

In sand castings there is a marked diminution in the number of relatively large crystals at the bottom of the casting ingot and a corresponding increase at the top, showing that the crystals have a lower specific gravity than the liquid tin-rich matrix in which they are found, and a tendency to rise to the top is noted when slow solidification is permitted.

The structure of these alloys should not be excessively fine or coarse, and the best results are obtained when poured at a temperature slightly over the freezing point. A casting or pouring temperature of 300 deg. C. is not likely to produce a uniform structure, since this temperature is just below the liquidus of the alloy and the liquid already contains crystals of one of the constituents.

On the other hand, a casting temperature of 600 deg. C. produces a coarse crystalline structure with large antimony-tin cuboids. A casting temperature of 400 deg. C. produces cuboids of smaller dimension, but the copper-tin constituent does not form the network characteristic of slow cooling when warm sand molds are employed. In chill castings there is considerably less difference between castings poured at 300 and 400 deg. C. respectively than in sand castings. A fine granular structure is seen in both cases, but it is more uniform when poured at the higher temperature.

[1] "Observations on a Typical Bearing Metal," by Fry and Rosenhain; British Institute of Metals, 1919, vol. 2.

The antimony-tin cuboid crystals in chill-cast alloys are uniformly distributed throughout the entire section, whereas a concentration of these crystals is found at the top of sand castings. During solidification there is a tendency with certain mixtures for the antimony-tin cuboids to rise to the top of the metal, and the only method of prevention lies in chilling the molten metal to bring about rapid solidification.

A distinct softening is noticeable at a temperature of 100 deg. C. and it is thought that the hardening effect of rapid cooling indicates that the rate of cooling rather than the casting temperature controls the ultimate hardness.

Under scleroscope test a chilled alloy has a hardness practically double that of the slowly cooled metal (12 or 13 against 6 or 7), while the Brinell impressions are almost identical (28 and 25 respectively). Hence the hardness produced by rapid cooling is more apparent under comparatively light load than under a heavy load. It becomes necessary therefore to review carefully the duty which a bearing metal has to perform in considering the desirability of heat-treatment. Extremely slow cooling of the molten metal produces a dangerous crystalline structure which may lead to the development of cracks under service conditions in a similar manner to that which may obtain as the result of a high pouring temperature.

Service results depend very largely upon careful and skilled manipulation during pouring operations, and the procedure listed below is a very successful method of lining a bronze shell of the class employed in automotive construction. To prevent oxidation and loss of the antimony constituent it is essential that small quantities of metal only are melted. Where a large number of shells are manipulated, it is very desirable to have a number of small melting pots conveniently arranged with spouts and handles which are in turn immersed in a superheated bath of old metal for the purpose of melting the new metal. Extreme cleanliness and considerable attention to detail are necessary in the production of high-grade bearings.

To prepare the shell:

(1) Heat it in a bunsen flame to dull red.
(2) Immerse it in strong boiling solution of caustic soda for one minute.
(3) Tin carefully and completely over a bunsen flame with solder containing 30 per cent Pb and 70 per cent Sn, employing the following flux: anhydrous zinc chloride 50 per cent, ammonium chloride 49 per cent, and sodium fluoride 1 per cent.
(4) Wash in clean boiling water to remove flux.
(5) Mount in a fixture which should set the horns of bearing in the highest position and provide a suitable header.

Preparation of metal:

(1) Employ small melting pots conveniently arranged with spouts and handles.
(2) Carefully clean and coat pots with black lead prior to each pour.
(3) Do not melt more than 1 or 1½ lb. of metal in each pot.
(4) To melt metal immerse pots in a bath of old molten metal provided with suitable burners to maintain between 325 and 350 deg. C.
(5) Stir well and frequently.
(6) Graphite may be used as a flux to prevent oxidation.

Pouring:

(1) Preheat fixture and shell by immersion in bath of molten metal at 325 to 350 deg. C.
(2) Puddle cast with clean wire to insure that air or gas bubbles rise to header.
(3) Quench in water when metal solidifies.

Thermal Treatment

Heat-treatment is unnecessary in small bearing shells,

since no difficulty is experienced in cooling them with sufficient rapidity to obtain the desired structure. It is advisable to heat large bearings to a temperature of approximately 150 deg. C. and quench in water. This eliminates segregation of the antimony-rich cuboids.

Physical Properties

The resistance to tension of a bearing metal has no direct relation to its anti-friction qualities. Since no bearing alloy is ever expected to sustain tension strains, no information is available. Elongation and reduction of area are the only data resulting from a tensile test which could possibly be considered of value. It may be assumed that a large reduction of area indicates great ductility which under service would cause a bearing to spread or squeeze out under relatively small loads. Conversely, it may be expected that a comparatively high tensile strength, accompanied by little or no reduction of area or elongation, is best suited for bearing purposes.

The general rule that the brittleness of an alloy increases rapidly with hardness does not obtain in the tin-rich alloys, which, even with relatively high hardness values, show no signs of brittleness under impact stresses. The presence of nickel up to say 0.50 per cent considerably increases the ductility of tin-antimony-copper bearing metals. Cracks may develop as the result of a high casting temperature, particularly if the bearing be subjected to repeated shock or vibration.

It is thought by some authorities that the scleroscope hardness test excels the Brinell method on account of greater differences revealed after heat-treatment. The writer is strongly of the opinion that the scleroscope test has little value, since considerable variation in the readings must obtain on account of the essential characteristic of the alloy, which demands hard bearing points imbedded in a cushion or matrix of softer material. It is evident, in the absence of any definite relationship between hardness and wearing qualities, that any form of hardness test applied to this type of material has little merit in the consideration of endurance qualities.

However, there is a relationship between Brinell hardness and compressive strength in tin-rich alloys. It may be noted here that a mixture having a Brinell hardness 34 has an approximate compressive strength of 24,000 lb. per sq.in., and that with a decrease of hardness value there is a proportionate increase of strength under compressive load within a range terminated by an alloy having a Brinell hardness 20 accompanied by a compressive strength of about 42,000 lb. per sq.in. The compression figures indicate the load which the metal will withstand without cracking, and the limits of the range quoted represent the extreme conditions observed by the author. Chemical composition and rate of cooling considerably affect the hardness values and the ability of an alloy to withstand compression stresses.

Mechanical Tests

The writer recently examined very exhaustively nine high-grade proprietary tin-rich bearing metals with the object of determining their relative suitability for high-powered automobile engine construction. Table I shows their chemical composition.

Each alloy was poured at the respective temperature recommended by its maker, as shown in Table II, and all test-pieces and test-bearings were heated to the temperature named and quenched in water with the object of eliminating the segregation of antimony-rich cuboids.

TABLE I—CHEMICAL ANALYSES OF ALLOYS SELECTED FOR INVESTIGATION

Alloy No.	Chemical Analysis				
	Tin	Antimony	Copper	Lead	Ni
1	90.8	4.1	3.8	1.02	....
2	83.3	11.0	3.9	0.92	....
3	80.9	10.7	4.2	3.3	....
4	89.9	4.3	4.2	1.3	....
5	86.3	10.3	3.2	nil.	....
6	60.2	12.0	6.3	19.9	....
7	90.8	4.3	3.9	trace	0.53
8	87.3	7.5	4.6	0.62	....
9	77.5	11.2	10.0	0.75	....

TABLE II—HANDLING TEMPERATURES AND BRINELL HARDNESS

Alloy No.	Pouring Temperature, Deg. C.	Annealing Temperature, Deg. C.	Brinell Numeral
1	370	150	26
2	350	150	28
3	350	150	31
4	370	150	30
5	400	150	30
6	400	150	34
7	350	150	20
8	400	150	33
9	400	150	31

TABLE III—COMPRESSIVE TESTS ON 1-IN. CYLINDERS, 1-IN. LONG

Alloy No.	Deformation Under 8,000 Lb. Per Sq.In. Increase in Diameter	Deformation Under 8,000 Lb. Per Sq.In. Decrease in Height	Deformation Under 16,000 Lb. Per Sq.In. Increase in Diameter	Deformation Under 16,000 Lb. Per Sq.In. Decrease in Height	Load to Produce Crack, Lb. Per Sq.In.	Dimensions at End Diameter	Dimensions at End Height
1	0.0050	0.0060	0.0490	0.0680	40,000	1.58	0.46
2	0.0020	0.0037	0.0340	0.0490	29,550	1.35	0.60
3	0.0010	0.0020	0.0170	0.0270	34,340	1.32	0.63
4	0.0020	0.0020	0.0330	0.0500	30,000	1.36	0.60
5	0.0028	0.0030	0.0420	0.0600	30,000	1.38	0.57
6	0.0018	0.0030	0.0138	0.0210	24,100	1.33	0.64
7	0.0105	0.0130	0.1259	0.1980	42,800	1.74	0.36
8	0.0020	0.0022	0.0450	0.0450	30,000	1.32	0.63
9	0.0040	0.0040	0.0300	0.0500	30,000	1.27	0.66

TABLE IV—COEFFICIENT OF FRICTION OF ALLOYS

Alloy No.	Temperature			Friction in Lb. at Journal Surface			Coefficient of Friction		
	Initial	After 4 Hr.	Increase	120 Deg. F.	140 Deg. F.	Maximum Temp.	120 Deg. F.	140 Deg. F.	Maximum Temp.
1	60	137	77	15.94	11.56	11.56	0.0033	0.0024	0.0024
2	60	144	84	30.00	20.94	18.75	.0062	.0044	.0039
3	60	160	100	27.19	21.56	19.38	.0057	.0045	.0040
4	60	167	107	15.00	13.44	10.94	.0031	.0028	.0023
5	60	144	84	21.87	16.25	16.25	.0046	.0034	.0034
6	60	144	84	19.69	14.37	12.50	.0041	.0030	.0026
7	60	149	89	18.12	12.50	11.25	.0038	.0026	.0023
8	60	139	79	16.87	14.69	13.75	.0035	.0031	.0029
9	60	139	79	17.81	14.37	14.06	.0037	.0030	.0029

Brinell hardness tests are noted in Table II, and results of compression on cylinders 1 in. diameter and 1 in. long are given in Table III.

Coefficients of friction varied from 0.002 to 0.006 depending upon the temperature and bearing, as shown in Table IV. In performing these tests, a bronze bearing block was given a ½-in. white metal lining.

A 6-in. journal was rotated, at 360 r.p.m. (565 ft. per min.) for several days, both in forward and reverse direction, in order to obtain a perfectly smooth bearing surface. The surface of the bearing measured 4.8 sq.in., and was loaded with 4.800 lb., or 1,000 lb. per sq.in. Lubricant used was sperm oil. Tests were run for 4 hours, with the journal rotating in either direction, and average results are given in the table.

It was intended to test the resistance to wear, using a standard bearing and journal, and under varying conditions of load, oil pressure and temperature, and journal speed. Preliminary trials with two of the bear-

TABLE V—TESTS ON BEARINGS RUN DRY

Time Elapsed, Min.	Alloy No. 1		Alloy No. 3		Alloy No. 3		Alloy No. 4		Alloy No. 5		Alloy No. 6		Alloy No. 7		Alloy No. 8		Alloy No. 9	
	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)	Bearing Temperature, Deg. F.	Journal Surface Friction (Lb.)
5	73	20.0	79	32.5	77	27.5	77	32.5	78	45.0	72	30.0	71	21.2	75	26.2	79	23.7
10	85	31.2	92	27.5	87	25.0	87	26.2	90	41.2	81	26.2	81	20.0	86	21.2	90	27.5
15	128	88.7	104	25.0	140	140.0	100	35.0	138	85.0	101	43.7	102	23.7	106	30.0	106	30.0
20	155	67.5	110	23.7	171	80.0	114	41.2	169	147.5	125	130.0	149	85.0	111	38.7	123	160.0
25	184	80.0	114	22.5	182	55.0	123	43.7	178	65.0	165	80.0	184	148.7	143	47.5	145	30.0
30	182	50.0	118	22.5	177	48.7	130	45.0	194	80.0	157	45.0	200	60.0	144	21.2	151	30.0
35	180	43.7	122	35.0	193	78.7	143	48.7	253	240.0	157	43.7	212	80.0	142	21.2	159	37.5
40	183	50.0	132	35.0	266	290.0	160	95.0	320(*M*)	(c)	157	43.7	234	60.0	142	21.2	162	22.5
45	187	50.0	139	32.5	297	(b)	172	65.0	...	...	158	42.5	253	158.7	143	21.2	181	40.0
50	192	47 5	143	46.2	...	...	184	63.7	...	...	159	42.5	307	189	144	20.0	178	31.2
55	192	40.0	162	45.0	...	...	188	70.0	...	...	159	42.5	331(*M*)	(a)	150	28.7	176	35.0
60	191	37.5	253	287.5	...	...	212	105.0	...	...	195	180.0	...	...	151	30.0	190	30.0
65	193	40.0	302(*M*)	(a)	...	...	248	80.0	...	...	257	165.0	...	...	169	150.0	221	40.0
70	205	52.5	...	...	...	...	255	97.5	...	...	277	112.5	...	...	235	155.0	264	140.0
75	205	42.5	...	...	...	...	273(*M*)	(b)	...	...	282(*M*)	(a)	...	...	255	158.7	325(*M*)	300.0(a)
80	243	82.5	...	...	...	...	...	...	...	...	...	...	...	...	318(*M*)	(a)	...	...
85	243	75.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
90	298(*M*)	(a)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(*M*) Bearing melted.
(a) Bearing slightly fused but none adhered to journal.
(b) Bearing badly fused, and metal adhered to journal.
(c) Bearing badly fused but none adhered to journal.

ing metals indicated that the wear exhibited after a considerable period was infinitesimal. Since little information of value was likely to be obtained from tests extending over many months, it was decided to abandon this project and to proceed with durability tests (which form the subject of Table V) in order to obtain comparative values with respect to the behavior of each alloy in the unlubricated condition. The same bearing and journal used to determine the coefficient of friction was used. However, the load was reduced to 500 lb. per sq.ft. On starting the test, the bearing was flushed with sperm oil at 60 deg. F. for a period of 10 minutes, when the bearing was drained. From then on the temperature and friction were observed at intervals of 5 minutes until the alloy fused.

The interpretation of the mechanical tests recorded must be governed by the particular application for which the bearing alloy is required, and while the investigation indicates that the metals examined are without exception of a very high order, it should be noted that the order of merit has particular reference to their suitability for high-powered automobile engine bearings.

First place must be given to alloy 1, which can withstand exceptionally high compression load without cracking, has a moderate dimensional change under excessive load, an exceptionally low coefficient of friction, and will run longest when dry. Second place was assigned to alloy 8. It also stands great loads before cracking, has a moderate dimensional change under high load, has a low coefficient of friction, and will run over an hour dry without melting. Alloy 9 is a close third, attaining the desirable qualities to only a slightly lesser degree. Alloy 4 is ranked next, its rather quick failure when running dry being counterbalanced by an exceptionally low coefficient of friction.

The German Vegetable-Oil Crushing Industry

The present condition of the German vegetable-oil crushing industry with regard to the number of mills, the working force, amount of raw material treated, and the output, as compared with the last pre-war year, was reported in *Commerce Reports* of Aug. 14, 1922, and is shown in the following table:

	1913	April 1, 1921, to April 30, 1922
Number of mills	134	95
Number of workmen employed	6,700	10,000
Amount of tons of oil fruit crushed	1,800,000	670,000
Output of oil in tons	650,000	265,000

The present capacity of all the German oil mills amounts to about 2,200,000 tons of oil fruits—i.e., more than three times the actual output. In 1913 Germany exported about 70,000 tons of oil. In 1921 the imports amounted to 163,000 tons.

The share of Greater Hamburg in the German oil industry compared with the provinces of Mecklenburg and Schleswig-Holstein is about 55 per cent. Harburg, a thriving industrial city near Hamburg, is an especially important oil center.

It is of interest to note the increase in the number of laborers, the main reason for which is stated to be the introduction of the 8-hour working day.

Dutch capital is strongly interested in German oil mills, and at present no legal discrimination exists against foreign capital.

Collapse of the Carbide and Cyanamide Industries at Odda

Recently the plant of the Alby Carbide Co. at Odda was sold at auction for 50,000 crowns to satisfy judgments amounting to 1,900,000 crowns, and the plant of the Northwestern Cyanamide Co., a subsidiary of the Alby Co., for 200,000 crowns, to satisfy debts aggregating more than 11,000,000 crowns. Both plants were bid in on behalf of the Tyssefaldene Power Co., which was the chief creditor of both concerns. This marks the final collapse of two of the largest industrial undertakings in western Norway and the practical bankruptcy of the community of Odda, which is now petitioning the state for a moratorium and for cancellation of taxes. These plants employed from 800 to 1,100 men.

The Alby Co. was a British corporation organized with a capital of £725,000 and registered in Norway in 1907. Between that time and 1918 the capital was increased to a total of 15,000,000 crowns. Its plant was built on ground leased from the Tyssefaldene Power Co., and at maximum operation had an annual output of about 90,000 tons of calcium carbide. The Northwestern Cyanamide Co. was organized with a capital of 2,000,000 crowns to utilize part of this output and for several years took from 50,000 to 60,000 tons annually of the product for conversion into cyanamide, a fertilizer material. The remainder of the product was exported.

Properties of Salt Solutions

By W. L. Badger
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IT HAS BEEN the experience of the writer in connection with his consulting work in salt manufacture that it is often difficult to obtain usable data on the properties of sodium chloride solutions. Some of the data which have been found most useful in connection with problems of design and operation of equipment for salt refining have been collected and plotted on a comparatively large scale. These curves are reproduced in the accompanying charts in the hope that they might be of service to other workers in this field.

How to Use the Curves

Boiling Point of Saturated Solutions. In Fig. 1 curves *A* and *A'* are for saturated salt, and curves *B* and *B'* for water. Enter the chart at the bottom with the temperature at which water boils under the pressure considered, go up to Curve *A*, and read the boiling point at the left. The vertical distance between *A* and

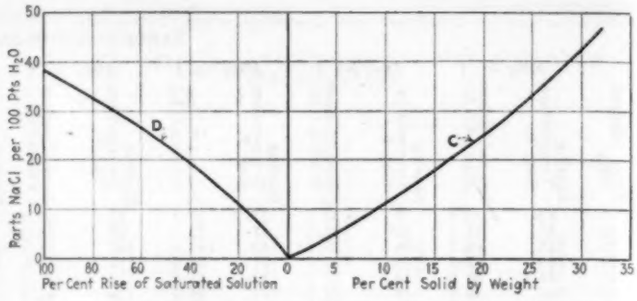


FIG. 2—COMPOSITION OF SALT SOLUTIONS; BOILING POINT OF UNSATURATED SOLUTIONS

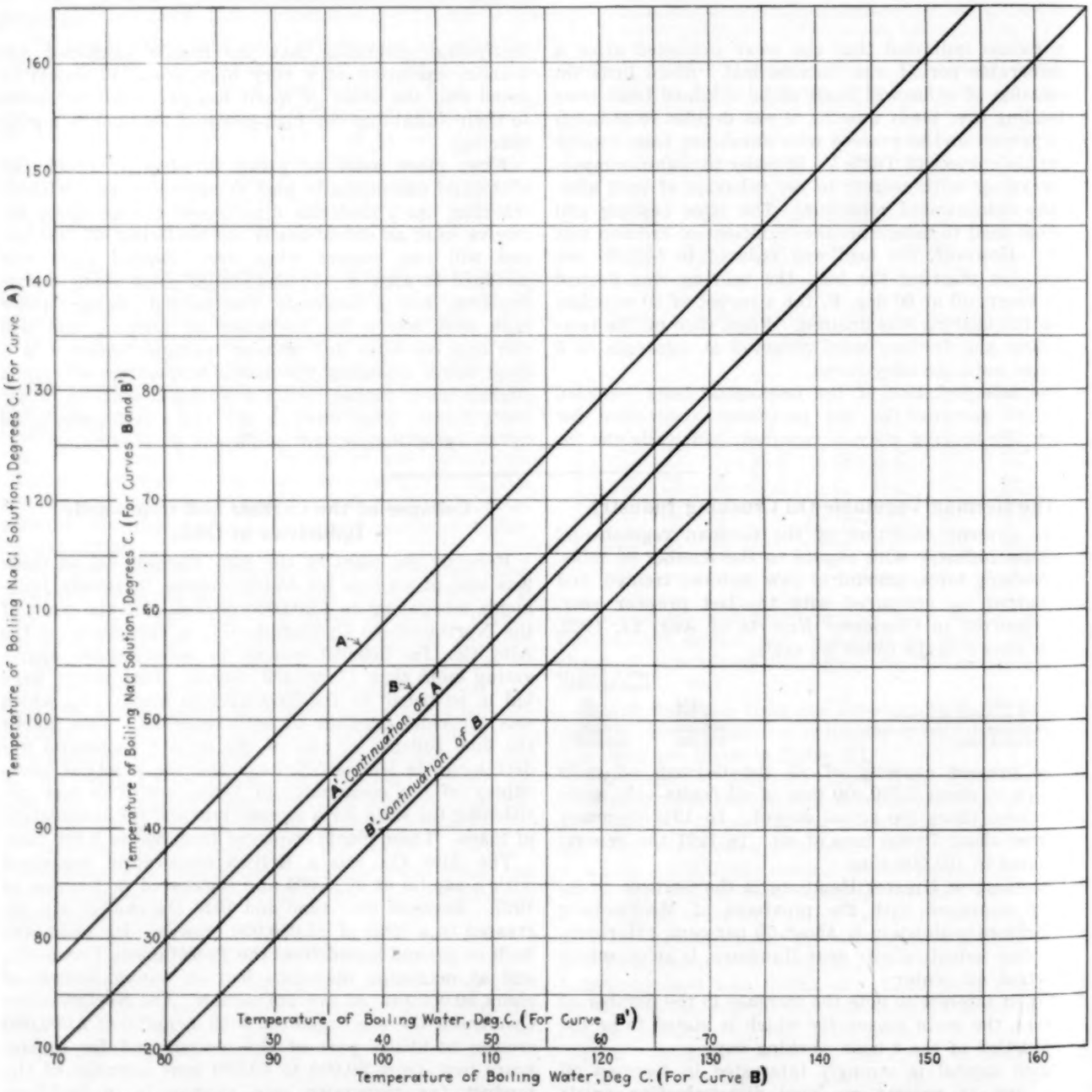

Temperature of Boiling NaCl Solution, Degrees C. (For Curve A)
Temperature of Boiling NaCl Solution, Degrees C. (For Curves B and B')
Temperature of Boiling Water, Deg. C. (For Curve B')
Temperature of Boiling Water, Deg C. (For Curve B)
A
B
A' Continuation of A
B' Continuation of B

FIG. 1—BOILING POINTS OF SATURATED SALT SOLUTIONS COMPARED WITH TEMPERATURE OF BOILING WATER AT VARIOUS PRESSURES

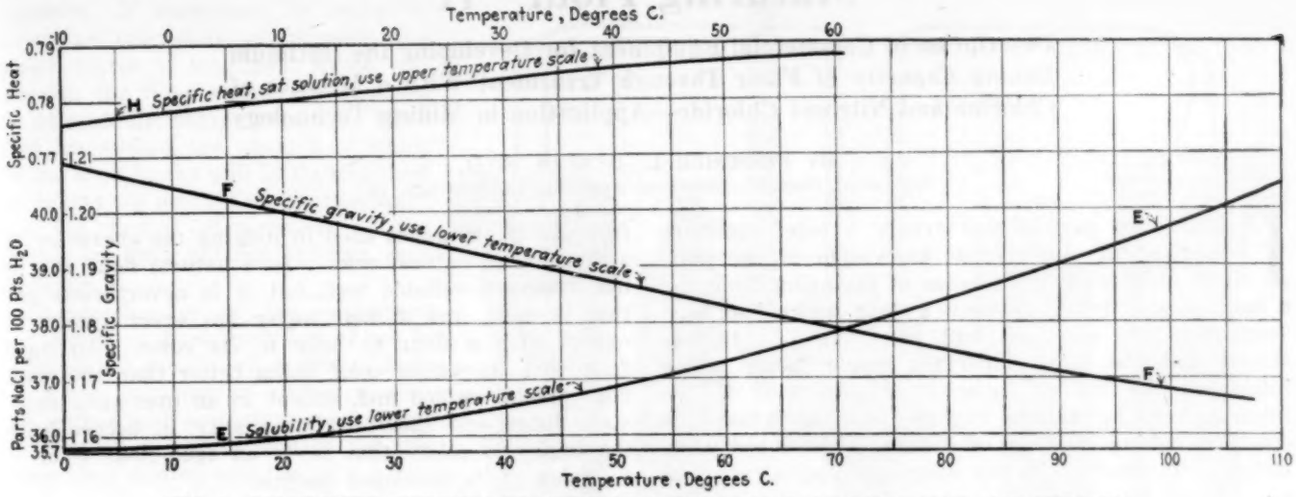

Temperature, Degrees C.
Specific Heat
Specific Gravity
Parts NaCl per 100 Pts H_2O
H Specific heat, sat solution, use upper temperature scale
F Specific gravity, use lower temperature scale
E Solubility, use lower temperature scale
E
F
Temperature, Degrees C.

FIG. 3—SOLUBILITY, SPECIFIC GRAVITY OF SATURATED SALT SOLUTIONS AND SPECIFIC HEAT OF SATURATED SALT SOLUTIONS

B is the rise in boiling point of saturatetd salt solutions. Data from Badger and Baker (*Chem. & Met.*, vol. 23, No. 12, Sept. 22, 1920) plotted as described by Baker (*Chem. & Met.*, vol. 25, No. 25, p. 1137, Dec. 21, 1921).

Composition of Salt Solutions. Parts salt per 100 parts water may be converted to per cent solids by weight, and *vice versa*, by Curve *C* shown in Fig. 2.

Boiling Point of Unsaturated Solutions. Enter Fig. 2 at the lower right-hand corner with composition of solution. Go up to Curve *C*, across to the left to Curve *D*, and then down to per cent rise. Determine the rise of a saturated solution at the pressure in question, and multiply this by the per cent just found. Based on data of Badger and Baker (*loc. cit.*).

Solubility. (Curve *E* in Fig. 3). Use the temperature scale immediately below the curve, and read parts salt per 100 parts water at the left. See Badger and Baker (*loc. cit.*).

Specific Gravity of Saturated Solutions. (Curve *F* in Fig. 3.) Use the same temperature scale as for solubility.

Specific Gravity of Unsaturated Solutions. (Curves *G* in Fig. 4.) This gives specific gravity at three temperatures.

Specific Heat. (Curve *H* in Fig. 3.) Use temperature scale above the curve. (Marks, Mechanical Engineering Handbook, original source not given.)

Authorities. Where no special reference is made, the data were taken from Landolt-Börnstein, Seidel, Comey, or other standard reference work. All the data found were plotted and a mean curve drawn, though in drawing the curve extra weight was given to those data which seemed most reliable.

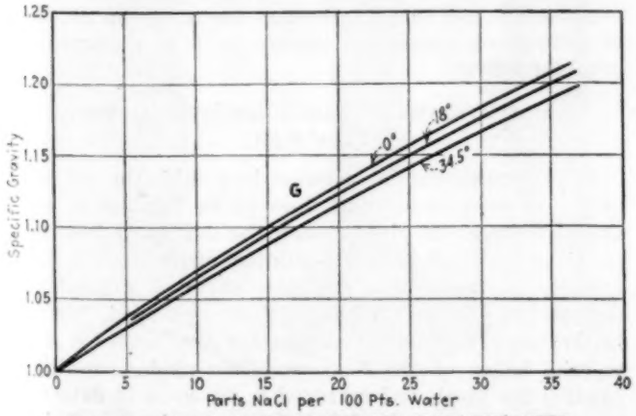


FIG. 4—SPECIFIC GRAVITY OF UNSATURATED SALT SOLUTIONS

Blueprint copies of these curves, assembled on a sheet 18x24 in. in either English or metric units, may be obtained from the author.

Evaporator Experiment Station,
University of Michigan,
Ann Arbor, Mich.

The Dye Situation in France

Industrial and technical publications, together with information drawn from local sources, reports Vice-Consul H. S. Fullerton, at Lyons, tend to strike a discouraging note in their survey of the French manufacture of colors. Expectations of extensive exports have not been realized and the creation of customs barriers against German dye imports into France have only partially succeeded in protecting French domestic manufacture, while competition with German and American products in foreign markets is fraught with increasing difficulties.

Import tariffs, whose purpose was the protection of the domestic dye industry, cannot cope with the situation, due to the infiltration of foreign dyes through countries enjoying immunities of minimum tariff and acting as intermediaries. Government subsidy is looked upon in many quarters as at least a temporary solution of the situation, it being estimated that a state grant of 40,000,000 to 50,000,000 francs annually might restore the vitality of these industries.

The alternative plan of government control is generally rejected. The accepted principle of the national necessity, especially in time of war, of active chemical industries of this order gives ground for the belief that some plan may be devised for their artificial stimulation, should such stimulation prove essential.

It might be added that the depression which has been noted in the dye industries would appear symptomatic of industrial chemicals in general in France.

Electrical Resistivity of Carbon

Determinations of the electrical resistivities of a number of different forms of carbon at different temperatures have been made at Seattle, Wash., by the United States Bureau of Mines. Different grades of coke, charcoal and carbon residues were studied. A paper describing the results is being prepared by Clyde E. Williams and Gordon R. Shuck.

Maturing Flour—II

Description of Commercial Equipment for Developing the Optimum Baking Capacity of Flour Through Treatment With a Mixture of Chlorine and Nitrosyl Chloride—Application in Milling Technology

By Frederick L. Dunlap, Sc.D.
Consulting Chemist, Industrial Appliance Co., Chicago, Ill.

In THE first part of this article[1] a brief summary was given of our present knowledge of the principles underlying the process of maturing flour and a parallel was drawn between a flour which had been "matured" and one that had been "aged." It was shown that the most important single factor which influenced the baking capacity of any flour is the intensity of the acidity of the flour and that the optimum baking capacity of a flour is developed when H-ion concentration in the dough is equivalent to a p_H of about 5.

There are many reasons for developing the intensity of the acidity of a freshly milled flour, as has been set forth. That this can be done successfully in a commercial way and that the results are all that have been claimed for them is clearly evidenced by the experience of 10 years of practical application of the Perfect Flour Maturing System.[2]

Although the discussion in Part I of this article was limited to the effects of pure chlorine on flour, there is also used in operating the Perfect Flour Maturing System a mixture of 99.5 per cent chlorine and 0.5 per cent nitrosyl chloride.[3]

Action of Nitrosyl Chloride

Nitrosyl chloride is undoubtedly one of the most effective agents known for treating flour. Experiments have demonstrated that 1 lb. of this reagent will handle 2,500 bbl. of flour in an efficient manner, while it is customary to use chlorine at the rate of 1 lb. for each 30 bbl. It is more efficient than chlorine for whitening flour, but less efficient for increasing the intensity of acidity. At present, however, the commercial distribution of this product is not feasible. It is readily obtained in a liquid state, but metallic containers which will stand up under commercial conditions have not as yet been developed. Liquid chlorine is, on the contrary, easily handled in containers of all sizes, up to and including tank cars, the latter having a 15-ton capacity. Experience has shown that the usual type of containers for liquid chlorine will resist the action of chlorine containing as much as 5 per cent of nitrosyl chloride, so that no difficulty is experienced in handling the mixture used in this system. This mixture of liquid chlorine and liquid nitrosyl chloride is made by the Electro Bleaching Gas Co., Niagara Falls. It is supplied to the trade in 100- and 150-lb. cylinders, and designated as Beta Chlora, to differentiate it from straight chlorine. Shipments are, of course, made in careful accordance with the government regulations for handling liquefied gases, and while many thousand cylinders have been shipped throughout all parts of the United States and to foreign countries as well during the past 10 years, there has never been a single instance of trouble arising from the handling of the containers.

As flour is aged, it becomes of a whiter color. In fact one of the gages used in judging the character of a flour is its natural color. In a natural flour this is not always a reliable test, but it is nevertheless one that is used, and a flour buyer has every reason to expect such a flour to bake to its color. An aged flour with its whiter color bakes better than the same flour freshly milled and, except in an over-aged flour, such flours will show baking quality in accord with the improved color—that is in an aged flour color is an index of its developed quality.

Now chlorine *per se*, when used to improve the baking quality of flour by increasing the intensity of acidity, does not improve the color of such a flour in keeping with its baking value. Experience has shown that the addition of only 0.5 per cent of nitrosyl chloride improves the color as well as aids in increasing the intensity of acidity, so that this mixture of 99.5 per cent chlorine and 0.5 per cent nitrosyl chloride simulates the baking as well as the color value of a naturally aged flour. In other words, Beta Chlora produces a flour with a whiter color, but such flours have the improved baking capacity which the color would lead one to expect.

In the handling of flour in the mill to develop the proper intensity of acidity, there are two variable factors to deal with, the character and volume of the flour stream and the quantity of gas to be applied to the flour.

It is always preferable to apply the gas to the primary grades before these are blended to constitute the particular brands that the mill markets. Experience has shown that better results can be obtained by treating the several grades according to the requirements of each, and then subsequently blending percentages of these to form the finished brands, than in attempting to treat the flour after blending has been accomplished.

While the separate streams subjected to treatment in any plant do not vary materially in their character, still they do vary somewhat in character and volume. This calls for equipment which can deliver the gas in a variable flow as conditions require, yet the equipment must be so constructed that each stream can receive only a standardized quantity of gas, which is always below that point where the flour would be overtreated and thereby develop too great an intensity of acidity, a condition similar to that occurring in over-aged flour.

Each Stream of Flour Receives Optimum Treatment

When equipment is installed in a mill, the character of the several streams of flour to be treated is determined in order to give to each the degree of treatment required to produce the optimum effect. This determination is made by a complete chemical analysis and the use of a standard outfit fully equipped, installed in the laboratory of the Industrial Appliance Co. Commercial bakes of the flour are then made, running in parallel the fresh and matured flour, so as to determine the effectiveness of the treatment given. This is

[1] *Chem. & Met.*, vol. 27, p. 174; July 26, 1922.
[2] This system is controlled by the Industrial Appliance Co., Chicago, Ill.
[3] U. S. Pat. 1,071,977 covers the use of chlorine; U. S. Pat. 1,096,450 covers the use of the mixture of chlorine and nitrosyl chloride.

repeated, if necessary, in order to learn as accurately as possible the exact degree of treatment which will develop the flour stream in question to its optimum baking capacity. With this knowledge, the equipment which is installed in the mill is standardized to deliver the amount of gas necessary for the proper development of the particular flour passing through each agitator.

Standardization of the equipment for supplying a constant flow of gas is effected by means of a silver disk. This disk contains an orifice of such a size that with a constant head of gas back of it, it cannot deliver for use more than a rated quantity of the gas.

Control Equipment

The simplest plan for discussing the control equipment is to use a single-control machine as the basis. This machine treats but a single stream of flour—i.e., the finished flour—and is the type for use in small mills only, say those of a daily capacity of 50 to 100 bbl. of flour. The equipment is shown in Fig. 1.

Before describing the flow of gas in this type of equipment, it should be pointed out that in the single- as well as the multiple-control machines, the gas, before entering into contact with the flour, is highly diluted with air, thus insuring more even contact and distribution within the agitator.

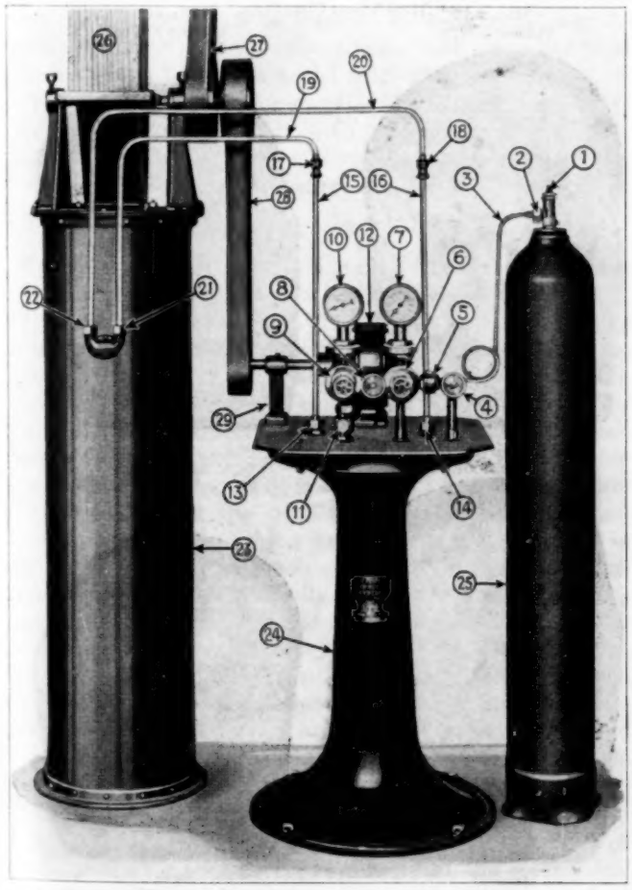


FIG. 1—SINGLE-CONTROL MACHINE FOR TREATING FLOUR

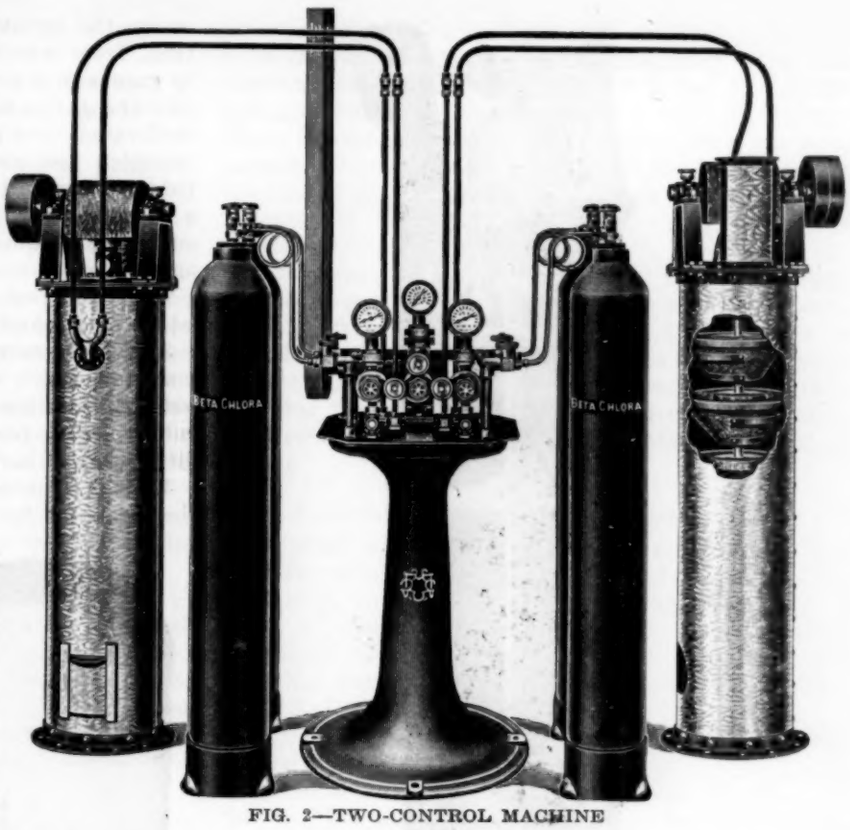


FIG. 2—TWO-CONTROL MACHINE

In the equipment shown in Fig. 1, the course of the gas is from cylinder 25 through valve 1, copper tube connection 3, main connection valve 4, gas strainer 5, initial regulating valve 6, control cut-out valve 8, control valve 9, orifice in silver disk 11, gas line 13, 15, 17, 19 and 21 into distributor in agitator 23.

The air current from blower 12 passes through air line 14, 16, 18, 20 and 22, mixing with the gas in distributor and circulating it through the suspended particles of flour in the agitator.

Gage 7 gives the pressure of gas in the cylinder in pounds and indicator 10 registers the amount of gas (in ounces and fractions thereof per barrel) going to agitator to be applied to the flour.

To start operation it is only necessary to open cylinder valve 1, then valves 4 and 8 and screw in handwheels on valves 6 and 9 until indicator 10 registers the degree of treatment desired. The degree of treatment may be regulated within prescribed limits at the will of the operator, by adjustment of the handwheels on valves 6 and 9.

Irrespective of the pressure of gas in the cylinder, the control apparatus automatically maintains a constant flow of gas at whatever point the operator has adjusted it—that is, while the standardized silver disk in this case will limit the maximum flow of gas, it is within the power of the operator to use a smaller quantity of gas if necessary and desirable.

Fig. 2 shows a two-control machine to which are attached reserve cylinders, so that the treatment may proceed without interruption when empty cylinders are replaced. This machine treats two streams of flour simultaneously. A separate control is provided for each stream of flour, graduated to meet its special requirements. An indicator on each control registers

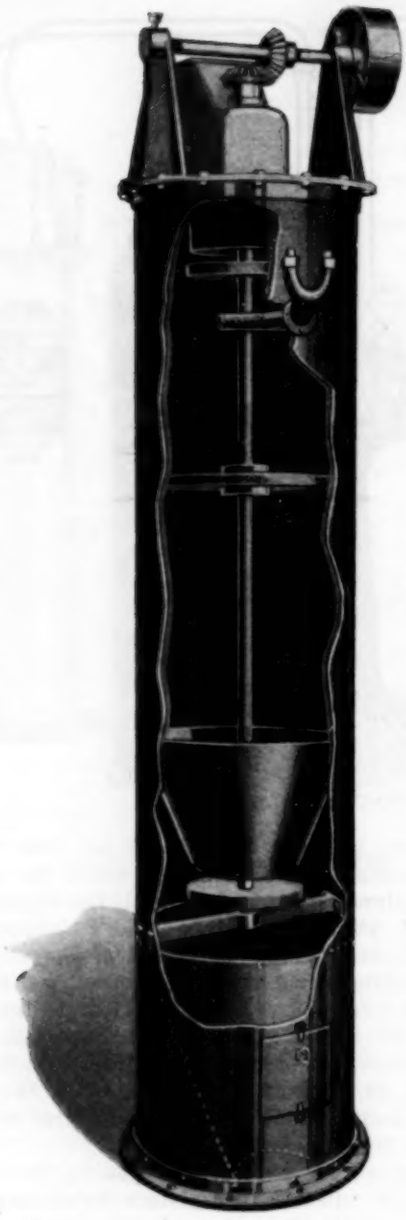


FIG. 3—AGITATOR

the amount of treatment to be given each stream. After passing through the control machine, the active agent is conveyed to the agitator through a ½-in. lead tubing. The air current is pumped from the control machine through a similar tube and mixed with the active agent as it enters the agitator.

This fills the space inside the agitator with the active agent diluted with air and circulated so that it reaches each separate particle of the flour, insuring full and uniform results.

The Agitator

So great are the absorptive properties of flour for the maturing agent that the method of agitation is of paramount importance in obtaining the best results. A standard agitator has been designed to obtain the highest efficiency in results on the product and to provide for the greatest durability in service.

This agitator embodies the following essential features:

1. It suspends the particles of flour in the air in a manner that insures uniform treatment. The flour enters the agitator through a center spout into a feed ring, from where it is distributed in an even spray by means of a revolving disk. Immediately under this disk the gas is forced with a current of air through a perforated hard-rubber siphon, insuring its even distribution and circulation through the suspended particles of flour. In the middle of the treating chamber a hard-rubber wheel serves further to agitate the flour and bring it into more intimate contact with the active agent.

2. It does not admit of any flour lodging, accumulating or remaining in the agitator for overtreatment.

3. The interior of the agitator is constructed of materials which will withstand the action of gas without deterioration. The metal case is lined, a hard-rubber sleeve protects the shaft, and all the interior fittings are of hard rubber.

4. It is adjusted to prevent the escape of gas through the intake or outlet spouts.

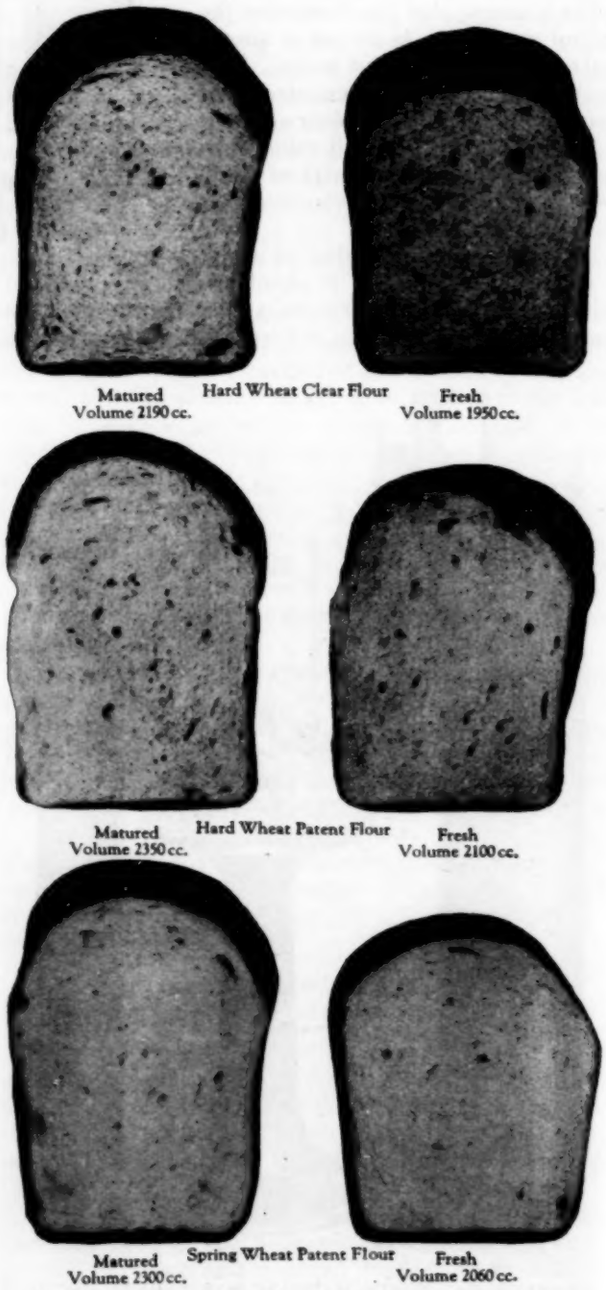


FIG. 4—FRESH AND MATURED FLOUR COMPARED

5. It is easily accessible for inspection or adjustment.

6. It is equipped throughout with ball bearings to provide for easy running with the least amount of attention.

While Figs. 1 and 2 illustrate the general principle of the relation of one part to another in the assembled equipment, it is not essential that this particular arrangement should be followed in the installation in the plant. The agitators can be placed where convenient in the flow of the finished flour ahead of the packers and the control machine can be located where preferred. Its distance from the agitators does not affect results.

The system has been perfected and constructed, both as to materials and arrangement, with the end in view that it may be effective and practical and not require undue care and attention.

Its operation does not entail any discomfort or casualty risk to the operatives, or fire hazard to the proprietors.

Additional controls assembled on the same stand to meet the requirements for the treatment of a greater number of streams of flour are simply duplicates of the initial units which have been described in detail. Standard machines are made with as many as eight separate controls. When there are a greater number of separate streams of flour in any plant, duplicate machines are provided.

Photographic Evidence of Improved Baking Qualities

Fig. 4 gives photographic reproductions of bread made with fresh and matured flour, the latter produced with Beta Chlora. It is difficult in a pictorial way to show adequately the improvement both in color and texture which this treatment brings about.

These were actual commercial bakes, but each flour was handled in accordance with its nature, so as to produce the best loaf of which it was capable and just as it would be handled by any competent baker.

Summary

In the first part of this paper the scientific grounds for the treatment of flour with chlorine were set forth. This treatment increases the intensity of the acidity in the flour to that point where the flour so treated develops its best baking strength. In other words, when chlorine is used properly, the flour takes on those optimum baking properties which develop in an aged flour. Other advantages also result from the chlorine treatment—namely, the stabilizing of this optimum baking value and the development of the color commensurate with the baking value of the flour, just as in the natural aging process. The development of rope is also controlled successfully and, while no great stress was laid on it, the treated flour may be successfully used by the baker with less yeast and sugar. Considering the enhanced quality of the finished flour as well as the oven products produced from it and the fact that the treatment may be applied at a cost not to exceed one cent per barrel, the application of this principle should meet with great commercial success.

The application of the Perfect Flour Maturing System in a practical way extends now over a period of many years. Experience has developed the mechanical features, which have been discussed in the present article, so that the system works with little or no attention on the part of the mill operative. The results claimed for this method of treatment have been substantiated through its years of actual use in the mill and have met with such favor that the Perfect Flour Maturing System is now in mills having a daily capacity of treated flour of over 300,000 bbl. so far as the United States is concerned, and in addition of over 200,000 bbl. in foreign countries, where its use is rapidly extending.

The system, because of the marked beneficial results produced, has become practically an economic necessity, for it brings to the consumer, to the baker or householder, the flour in a condition to render its most perfect service. Because of this it may be truthfully said that the extended use of the Perfect Flour Maturing System has meant a marked advance in the art of milling.

Accidents in Mills and Smelters in 1921

Accidents at all mills and smelters, excluding iron blast furnaces, operated in the United States in 1921 resulted in the death of 27 employees and the injury of 4,494, according to reports received from operating companies by the federal Bureau of Mines. In the preceding year 61 employees were killed and 8,863 were injured.

At milling plants 10,047 men were employed, of whom 4 were killed and 1,214 were injured, as compared with 21 killed and 2,624 injured during 1920. The fatality rate in 1921 was 0.50 and the injury rate was 151.05 per thousand employees, based upon a standard of 300 work days per year, as against rates of 1.31 killed and 164.24 injured the year before. The total working time was 2,411,148 shifts, and represents an average of 240 days per man. The number of men employed represents a reduction of 37 per cent.

At the smelters 18,656 men worked 5,733,969 shifts, an average of 307 days per man, as compared with 24,944 men, 8,741,116 shifts and 350 days per man in 1920. Fourteen men were killed by accidents and 2,129 were injured, or 0.73 killed and 111.39 injured per thousand 300-day workers. The corresponding rates in 1920 were 0.69 killed and 142.33 injured.

At the outside or auxiliary plants operated in connection with the mills and smelters, 9 fatalities and 1,151 injuries occurred among 8,762 employees. The fatality rate per thousand 300-day workers was 1.08 and the injury rate was 138.54, as compared with rates of 1.11 killed and 116.19 injured in 1920.

As compared with the year 1920, reports submitted to the Bureau of Mines for 1921 showed a heavy reduction in the number of shifts worked in nearly every state in the Union. The total number of shifts worked by employees at mills was only 50 per cent of the number worked in 1920; employees at smelters worked only 34 per cent as many shifts, as in 1920; while employees at auxiliary plants worked only 54 per cent of the number worked in 1920.

Solubilities of TNT

Many organic explosives are purified by recrystallizing from solvent, but there is little accurate information on the solubilities. During the past year the explosives chemical laboratory of the United States Bureau of Mines at Pittsburgh, Pa., has prepared a paper for publication giving the solubility of TNT in eleven different solvents. The laboratory is now determining the solubility of tetryl and tetranitraniline.

Production Costs in the Whiting Industry During 1914, 1921 and 1922

AN INTERESTING byproduct of the recent tariff debate in the Senate and an example of an intensive effort accurately to appraise competitive conditions within one of our domestic chemical industries are found in an informal report of the United States Tariff Commission addressed to the chairman of the Senate Finance Committee. Some extracts from that report and the tabulated costs of production are presented in the following paragraphs:[1]

Summary of Conditions in the Industry

The weighted average cost of producing whiting for the first 4 months of 1922 was $18.47 per short ton. This represents a decrease of 9 per cent from the cost of $20.32 in 1921 and an increase of 108 per cent over the pre-war cost of $8.86 in 1914. It was found that the average cost of imported whiting, c.i.f. New York, duty not paid, for the months of April and May was $12.80 per short ton. This cost for imported whiting when contrasted with the average domestic cost in 1922 shows a margin of $5.72 per short ton in favor of the imported product. The difference between the lowest domestic and the average imported cost was $3.99 per short ton.

In connection with costs in the domestic industry, the commission must point out the evident lack of labor-saving devices in the grinding of chalk for the production of whiting. The manufacture of whiting is a comparatively simple operation involving the mechanical operations of grinding, floating with water to classify the production into various grades of fineness, filtering, drying and further grinding of the finished product being packed for shipment. From a mechanical engineering viewpoint there is no reason why the product should be handled from the time the crude chalk enters the grinders until the finished product is packed.

TABLE I—COMPARISON OF PRODUCTION AND IMPORTS, 1914 TO 1922 INCLUSIVE

Year	Imports* Short Tons	Imports* Percentage of Production	Production, Short Tons
1914	1,181	1.8	†66,000
1915	2,693	....	.....
1916	1,828	....	.....
1917	1,074	....	.....
1918	1,223	....	.....
1919	765	....	.....
1920	8,875	....	.....
1921	8,826	20.6	43,104
1922 (4 months)	‡2,379	11.5	§20,766

* Imports are fiscal years ending June 30 for 1914 to 1917 and from then on are calendar years.
† Figure is low, as does not include production of one firm.
‡ Total imports for first three months plus imports at New York for April.
§ Includes production of two firms for 6 months and does not include output of one firm.

The production of whiting is an industry which has been long established in this country, and with a few exceptions there has evidently been a lack of effort to keep labor costs at a minimum by the installation of modern and improved machinery. This statement cannot be applied to all manufacturers, as there are at least two firms which are working along progressive lines to install continuous apparatus which will result in a saving of labor and a reduction in cost. An examination of the costs by companies (Table III) shows that the labor cost ranged from $2.23 to $5.16 per short ton during 1922. From this wide variation it is apparent that certain manufacturers can reduce costs by improved equipment and design of plant.

[1] *Congressional Record*, pp. 12,382-5, Aug. 15, 1922.

TABLE III—DETAILS OF WHITING COST, BY COMPANIES, 1914, 1921, AND FOUR MONTHS 1922.

(Per short ton)

Company No.	Total Cost	Material	Direct Labor	Total Factory Overhead	Administration and Selling	Packages	Net Price	Profit or Loss
Four months of 1922								
1	$15.79	$6.55	$2.23	$3.25	$3.56	$0.20	$19.16	$3.37
2	18.74	6.36	5.16	4.23	2.99	*	22.04	3.30
3†	21.89	7.73	3.57	6.87	4.17	‡.45	27.66	2.11
4	17.69	8.62	3.43	3.00	2.03	.61	20.87	3.18
5†	20.41	8.93	4.87	3.78	2.71	.12	26.86	6.45
Weighted average..	18.47	7.39	4.04	3.87	3.05	.12	22.78	4.31
1921								
1	17.06	6.17	2.57	3.69	4.44	.19	22.54	5.48
2	22.29	6.18	5.62	5.51	4.85	.13	28.90	6.61
3	24.89	8.90	3.56	8.14	5.00	‡.71	24.26	—.63
4	21.04	9.76	5.39	2.65	2.79	.45	25.08	4.04
5	21.28	7.97	4.89	4.56	3.68	.18	24.72	3.44
Weighted average..	20.32	7.02	4.33	4.54	4.27	.16	24.52	4.20
1914								
1	7.96	3.21	1.05	1.88	1.69	.13	10.62	2.66
2	8.74	3.61	1.97	2.21	.93	.02	10.84	2.10
3	9.31	4.16	1.57	2.35	1.19	.04	9.81	.50
4	9.36	4.05	1.76	1.18	1.73	.64	10.51	1.15
5	9.98	3.93	2.12	2.96	.93	.04	12.01	2.03
Weighted average..	8.86	3.64	1.71	2.17	1.23	.11	10.65	1.79

* Profit of $30.60 for period on bags. † Costs covering 6 months, 1922.
‡ Indicates profit.

Foreign and Domestic Competition

The wide spread between the domestic and imported cost of whiting is in no small part due to existing exchange rates and will decrease as the Belgian and French exchange approaches normal. A factor in favor of domestic product, which is not shown in the cost figures, is the service to domestic consumers. The consumer in dealing with domestic manufacturers has the assurance that in the case of delivery of inferior goods immediate and satisfactory adjustment can be secured from the domestic producer, whereas in the case of the imported product it is evident that such adjustment is considerably more difficult. The point at which the price of imported whiting becomes sufficiently attractive to warrant a change from a reliable domestic source to an imported one cannot be measured accurately. For tariff purposes care must therefore be exercised in basing duties wholly on the spread between the domestic cost and the cost of the imported product landed in the United States.

A comparison of production and imports of whiting shows that imports have increased greatly since 1919. Table I shows a comparison of imports and production from 1914 to 1922, inclusive. In 1914 imports represented approximately 2 per cent of the domestic production and prior to 1920 never exceeded 2,700 short tons. During 1920 and 1921 they approximated 9,000 tons per annum, or about 20 per cent of the domestic production during the latter year. A comparison of imports and production for the four months in 1922 shows that imports were approximately 12 per cent of the domestic output. It is apparent that domestic producers since 1919 have received active competition from imported whiting.

Summary of Costs

Table II compares the costs of whiting for 1922, 4 months, with 1921 and the pre-war year 1914. This table also

TABLE II—COMPARISON OF THE TOTAL WHITING COSTS, 1914, 1921, AND 1922 (FOUR MONTHS)

(Costs are per short ton)

Period	Production Short Tons	Sales Short Tons	Total Cost	Material	Direct Labor	Factory Overhead	Administration and Selling	Packages	Net Price Received	Profit
4 months, 1922	*20,766	20,231	$18.47	$7.39	$4.04	$3.87	$3.05	$0.12	$22.78	$4.31
1921	40,019	39,755	20.32	7.02	4.33	4.54	4.27	0.16	24.52	4.20
1914	61,627	62,008	8.86	3.64	1.71	2.17	1.23	0.11	10.65	1.79
			(Percentage of total cost)							
4 months, 1922	.....	.....	$100.0	$40.0	$21.9	$21.0	$16.5	$0.6	$123.3	$23.3
1921	.....	.....	100.0	34.6	21.3	22.3	21.0	0.8	120.7	20.67
1914	.....	.....	100.0	41.1	19.3	24.5	13.9	1.2	120.2	20.20

* Includes production of two firms for 6 months.

TABLE IV—DETAIL OF COST OF WHITING IMPORTED AT NEW YORK, APRIL AND MAY, 1922

Country of Origin	Quantity (Short Tons)	Cost c.i.f. New York (Without Duty (Per Short Ton)	Ocean Freight (Per Short Ton)	Insurance, Consular Fees, Other Expenses (Per Short Ton)	Cost f.o.b. Foreign Port Packed (Per Short Ton)	Packing Cost (Per Short Ton)
Belgium.....	143.3	$11.79	$3.04	$0.085	$8.66	$1.99
	104.7	13.27	3.11	*.049	10.11	2.42
	84.0	11.25	2.12	.078	8.03	1.91
	117.6	10.99	2.96	.080	7.95	1.89
	44.8	9.89	2.95	.128	6.81	1.89
	33.1	15.50	3.03	.210	12.25	4.55
	40.5	18.89	3.07	.188	15.63	4.59
Germany.....	5.5	20.52	2.45	†.428	17.64	3.68
France.....	110.2	14.36	.....	.....	.....	.....
England.....	5.7	16.58	3.90	.....	12.68	3.90
Weighted av.	689.4	12.80	2.90	.09	9.36	2.39

* Insurance only. † Consular fee only.

shows the percentage of total cost represented by the items of material, direct labor, factory overhead, administration and selling, and packages. The total cost for 1922 was $18.47 per short ton. Of this total, $7.39, 40 per cent, was for material; $4.04, about 22 per cent, was direct labor; $3.87, 21 per cent, factory overhead; $3.05, 16½ per cent, administration and selling expenses; and 12 cents, less than 1 per cent, was for packages. The average net price received for whiting during 1922, 4 months, was $22.78 per short ton. A comparison of this price with the total cost indicates that the industry as a whole made an average profit of $4.31 per short ton, or about 23 per cent of the total cost. The cost for 1922 was more than double that of the pre-war year 1914. The material cost for 1922 was more than twice that of 1914; direct labor nearly two and one-half times as much; factory overhead about one and eight-tenths times; administration and selling about two and one-half times the same items in 1914. The average profit per ton of $4.31 in 1922 may be compared with $1.79 per ton in 1914; on the basis of percentage of total cost, however, the profit in 1922 was 23.3 per cent, as compared with 20.2 per cent in 1914.

Table III shows the variation in the cost of whiting according to companies. The costs listed under a given number are those of the same company for the three periods given.

A study of this table shows that the total cost in 1922 ranged from a low of $15.79 per short ton to a high of $21.89, a variation of about 40 per cent of the low cost. The greatest variation in the various items of cost occurs in that of direct labor. This item ranged from a minimum of $2.23 per short ton to a maximum of $5.16, or a variation of about 130 per cent of the low cost. The net price (freights and commissions deducted) received for whiting during 1922 (four months) ranged from $19.16 to $27.66 per short ton.

This table also shows that the average profit during the 4 months of 1922 ranged from $2.11 per short ton to $6.45:

Details of Cost of Imported Whiting

In Table IV is shown the detail of representative shipments of whiting entered at the port of New York—the point at which most of the whiting is imported—during the months of April and May, 1922. This information was obtained from the original invoices on record at the New York custom house. The shipments included in this tabulation represent in quantity a little over one-third of the total imports—1,981 short tons—at the port of New York for the months of April and May. By far the larger part of the whiting entering the United States at this time originated in Belgium, with France ranking second in importance. Very little whiting was imported from England and Germany.

This table shows that the weighted average cost of ten shipments of whiting aggregating nearly 700 short tons was $12.80 c.i.f. New York, duty not paid. This cost may be compared with a cost of $9.36 per short ton at foreign ports packed ready for shipment.

It should be noted that the difference between these two costs is not represented by the items of freight, insurance, consular fees, and other expenses, as it will be seen from the table that these items were not available in the case of all shipments. They are, however, included in the total cost c.i.f. New York in all cases. A study of this table shows that the total cost at New York ranged from $9.89 to $20.52 per short ton.

Legal Notes

By Wellington Gustin

Rules Governing Interpretation of Written Contracts Where Parties Dispute the Agreements

A statement of the rules governing the construction and interpretation of written contracts where parties dispute the agreements is aptly put in a case before the United States Circuit Court of Appeals by Judge Woolley. The case presents an action at law by the General Supply Co. and others against the Marden, Orth & Hastings Co., Inc., and another on a written contract. (276 Federal, 786.)

Verdict of Trial Court

The trial court under its interpretation of the contract directed a verdict in part—for the plaintiff it directed a verdict in the sum of $12,512.18, subject to a possible deduction of $3,000 according as the jury should or should not find this item a proper credit in defendant's indebtedness; and it submitted to the jury a counterclaim of defendants for $50,000, made up specifically of items for raw materials belonging to the defendants in the possession of the plaintiffs at the termination of the contract, valued at $38,416; work in process $2,620; containers, carboys, drums, etc., $7,727. The jury rendered a verdict for plaintiffs for the $12,512 as directed without deducting a $3,000 credit; and for the defendants it gave a verdict for $44,951. Judgment for the amounts followed.

From this judgment the plaintiffs alone sued out a writ of error challenging as insufficient, because of the court's alleged misinterpretation of the contract.

Intention of Parties to Contract Governs Interpretation

The Court of Appeals laid down the cardinal rule that the intention of the parties to the contract governs its interpretation. The law presumes that the parties understood the import of their contract and that they intended what its terms express. When a contract is clear and unequivocal its meaning must be determined by its contents alone; another meaning cannot be added by implication or intendment, but where the language is ambiguous or susceptible of several significations its meaning may be found in the subject matter, viewed in the light of the circumstances under which it was entered into.

Writing, if Reasonable, Is the Contract

Each party to the contract urged that the interpretation given it by the other was such that no reasonable person would ever have entered into the agreement. But the Court of Appeals regarded the language of the contract as expressing a reasonable and workable arrangement such as men in the respective positions of the parties might enter into with reference to the peculiar subject matter and in the light of the unusual circumstances surrounding the transaction. Now, it says, if the writing itself shows a reasonable undertaking of the parties and in this respect shows what they intended and all they intended, that undertaking is the contract. The court cannot go outside of its terms

to find something different, better or even more reasonable. With these observations the court sought the intention of the parties in the circumstances.

Terms of Contract

The important circumstance was that the war was on. Both parties needed production alone to make money. Defendant Chemical company was a large dealer, and, through subsidiaries, a manufacturer of chemicals, with ample capital. The plaintiff corporation, here called the Supply company, had a chemical plant at Perth Amboy, N. J. The stock of this company was mainly owned and the plant was operated by its president and treasurer. The plant was a small affair, costing about $6,000. The financial resources of the corporation, says the court, and the experience of those who conducted its business were not extensive. In short, the Supply company had a plant and little money; the Chemical company had money and wanted a plant. Both wanted more production. This desire was the reason for the contract in dispute, whereby the Supply company undertook for a period of 14 months—later extended to 36 months—to devote its factory exclusively to the manufacture of chemicals from raw materials exclusively supplied by the Chemical company and to sell the manufactured product exclusively to the Chemical company at a profit to the Supply company of 10 per cent on a cost reckoned on a basis agreed upon. Cost as agreed upon included monthly salaries of $150 to each of the operating officers of the Supply company and a monthly amortization of advances by the Chemical company for the enlargement of the plant.

Dispute Over Minimum Monthly Tonnage

Under this contract the Supply company enlarged its plant and increased production. At times the Chemical company showed an inclination to lag and thereupon the Supply company complained to the Chemical company that it was not delivering raw materials and supplying orders sufficient to enable it to make a "minimum monthly output of 7 tons of aniline oil, 4 tons of sulphanilic acid, and 4 tons of Orange II," a production to which the Supply company regarded itself entitled as a base for its minimum monthly profit. Thereupon the Chemical company increased its deliveries and maintained the same quite constantly until July 1, 1918, when on a declining market, it decreased its deliveries and orders. Later the armistice was agreed upon and the Chemical company ordered the Supply company to cease manufacturing on Jan. 1, 1919. The court found that this contingency was provided for in the contract, although the contract had yet 6 months to run and a large amount of unfinished supplies remained in the hands of the Supply company.

The Supply company construed the contract as imposing an obligation on the Chemical company to give orders and deliver raw materials in an amount sufficient to enable it to make a certain minimum monthly profit throughout the term of the contract; and therefore it brought this suit. Wholly different interpretations of the contract were advanced by both parties, resting on one particular paragraph. The correct construction was held to be that the Chemical company "asked for" and thereby promised to take "the products of the enlarged plant which shall be" the monthly tonnage named. The Chemical company was required "to take a specified amount," but the Supply company promised, quite indefinitely, "to use its best efforts so to increase the plant as to produce the quantity asked for." Here the Chemical company urged a lack of mutuality in the contract. The trial court, confining itself to this paragraph, held that as the Supply company had not promised to produce chemicals in any given amount, the promise of the Chemical company to take chemicals in a named amount was without consideration and therefore not enforceable.

Interpretation of Trial Court Found in Error

The Court of Appeals found the trial court in error in restricting its interpretation to this one paragraph. Looking at the whole contract, it says, a consideration for the Chemical company's agreement to take the monthly tonnage named may be found elsewhere in the contract in the Supply company's surrender of its plant and the devotion of its energies exclusively to production for the Chemical company. Therefore it held the contract was not void but enforceable.

Defendant Had Right to Terminate Contract

Yet while this contract partook of a business venture in which the common object of both parties was enlarged production to meet an abnormal market due to war, it was apparent to both that the war would end and with it the market. Therefore the Chemical company in promising to take the increased production of the enlarged plant in the amount of 7 tons plus 4 tons plus 4 tons of different chemicals monthly undertook to do so only "for the present and until further notice." And it gave that notice by ordering production to cease Jan. 1, 1919. The court thought this was not unreasonable and the real intention of the parties, and held that it gave the Chemical company the right to terminate the contract on reasonable notice. Therefore the court held that the Supply company was entitled to receive the total of the monthly differences between profits it would have earned under the contract had the Chemical company supplied it with materials and orders, and the profits it actually received, reckoned from the date of the contract to its termination by notice on Jan. 1, 1919. But it was not entitled to recover profits from this date down to the date named in the contract for its termination, which was about 6 months more. The judgment was reversed and the case sent back for retrial.

Heat Losses of Stored Coal

Calorimeter tests to determine the losses in calories of coal heated in the air for various lengths of time are being made at the Pittsburgh experiment station of the Bureau of Mines. At 125 deg. C. the following heat losses were obtained:

Time of Heating	Per Cent Loss	Time of Heating	Per Cent Loss
30 min.	0.30	3 hr.	1.01
1 hr.	0.26	20 hr.	3.3
2 hr.	0.311	46 hr.	5.7

Samples were heated for various periods of time ranging from ½ hour to 100 hours, and the calorific value determined by the coal laboratory. The results show no regularly increasing loss in heating value as the time of heating increases. The coal samples show a change of weight on heating. First a decrease in weight due to the loss of moisture is observed. The decrease is generally less up to 24 hours, when there is an increase in weight of 0.64 per cent. After heating 100 hours at 125 deg. C. there is an increase in weight of 1.35 per cent and a loss in heating value of 3.02 per cent.

Iron Ore Smelting by Electricity

ALFRED STANSFIELD, Birks professor of metallurgy at McGill University, Montreal, Canada, outlined some of the difficulties in the electric smelting of Canadian iron ores, in an address given Oct. 9, 1922, before the Cleveland Section of the Association of Iron and Steel Electrical Engineers. After tracing the history of the experiments at Sault Ste. Marie, Heroult (Calif.), and those in Sweden financed by the Jernkontoret, it became evident that the design of a successful furnace was no simple matter.

The "elektrometall" furnace, developed by the Swedes, was with some small exceptions the only one in successful commercial operation, but iron ores can be smelted successfully in the "Noble" furnace developed at Heroult and even in a plain, open-top, pit furnace, and these latter furnaces are preferable to the Swedish furnace for the production of gray foundry iron.

Gray Iron for Foundries

Whereas the Swedish furnace operates much like an ordinary iron blast furnace, in that ore reduction and even carbonization of the spongy iron is done by hot CO gas rushing up the stack, low furnaces, of course, must rely almost entirely upon direct contact with solid carbon for reduction and carburization. Doubt has been expressed that the latter will produce the gray iron required for ordinary foundry work in view of two facts: (1) The normal output of the Swedish "electrometal" furnace is white iron, despite its approach to conventional blast-furnace principles; (2) that it was found exceedingly difficult to make "synthetic iron" containing more than 2½ per cent carbon, when remelting steel scrap with granular carbon in an electric furnace. Professor Stansfield was quite positive that these two facts had been stressed unduly. The Swedes make low-carbon white iron, because that metal is more desirable for conversion into steel and wrought iron, and this is the use to which their production is put. Furthermore, synthetic pig iron carburizes so very slowly because the reaction takes place only at the surface of the bath, covered with floating carbon. Keller,[1] in France, showed how to get high carbon by charging the carbon and steel scrap in layers. Therefore a pit furnace would produce high-carbon iron if there remained a slight excess of carbon in the ore column when it finally reached the bottom. This residue of coke or charcoal would rest on the hearth, supporting the granular charge above, and submerged in the molten metal, dissolving therein. Then if conditions were correct—the furnace operating with a "free-burning" arc at high voltage—silicon would also be reduced and the furnace would produce the soft graphitic iron required for ordinary machinable castings.

Excess of Carbon in Charge Is Fatal

An electric furnace is quite sensitive to correct proportioning of the charge. An excess of carbon arriving at the hearth will remain there, and even accumulate if some lean charges are not forthcoming, gradually plugging up the furnace and stopping the operations. It cannot be burned out with more air at the tuyeres, for there are no tuyeres. It simply remains until some solid oxide reacts with it or the metal dissolves it away. On the other hand, a cumulative slight deficiency in carbon (in an electric furnace) means poor reduction, large slag loss and a hard semi-steel, low in carbon and silicon. Even the best of electric smelting furnaces are subject to these troubles—a low pit furnace has something the better of the Swedish shaft furnace, in that a much shorter time is required for a corrective charge to work its way to the seat of the trouble.

Experience with several furnace designs indicates that iron is smelted best when the arc is free burning—i.e., immersed in the charge but slightly—and surrounded by an incandescent crater of flame and gas. Deep immersion diffuses the heat because many more paths through the ore charge are offered by which the current can leak from electrode to electrode. Short circuits are then frequent and the voltage must be reduced; partial fusion and reduction occurs at many points, and the charge has a tendency to "hang up." Even worse conditions result if the electrodes are forced still lower into the molten slag or metal, when the furnace becomes completely short circuited.

Economic Considerations

Professor Stansfield pointed out that inherently electric smelting demanded cheap power. Two-thirds of a ton of fuel per ton of pig iron may be saved, but in general the electric energy required (½ hp.-yr.) costs more than that much coke, although it may cost less than the amount of charcoal that would be saved. It follows that the electric furnace is unlikely to replace the coke blast furnace, though it has successfully replaced the charcoal blast furnace in Sweden. It was his opinion, also, that electrical energy was far too valuable a commodity to be used permanently in such a crude operation as ore smelting. It could be done only on the "outposts of civilization," where the power might easily be developed long before the demands of culture and industry could absorb it. As population increased, their multifarious needs would warrant them paying a far higher price for electricity, and ore smelting would be discontinued. This is not a particularly bright outlook for the method, however. The speaker said the reason, in his opinion, why electric pig iron was not now being produced in Canada was on account of their high labor and material costs and a lack of a special market which could be filled by that special quality of iron. But is it not true that labor and materials are always high in the outposts of civilization and there is never a local market for special irons and steels?

Professor Stansfield considered that there was a field for the application of electric smelting of iron ores on a limited scale at points where conditions were especially favorable, but that any large-scale development of electric smelting must form part of a process in which the ore would be reduced to the metallic state in fuel-fired furnaces at a low temperature before entering the electric melting furnace for the production of steel.

[1] *Chem. & Met.*, vol. 22, p. 83, Jan. 14, 1920.

The Grignard Reaction and Organomagnesium Compounds

Dr. C. J. West of the National Research Council some time ago compiled a very complete bibliography of articles relating to the Grignard reaction. This bibliography and a discussion of the reaction are now available as No. 24 of the reprint and circular series of the National Research Council. The report is exceptionally complete and splendidly indexed by compounds and by authors. The report is for sale by the Council at $1.50.

New Invention Eliminates Accidental Explosion in Gas Mixtures

By Dr. H. C. P. Weber
Research Laboratory, Westinghouse Electric & Manufacturing Co.

THE accumulation of explosive gas mixtures in inclosed spaces is of frequent occurrence, and accidental ignition of these explosive mixtures in public places has led to disastrous results.

Thus the explosion of sewer gases in city sewer systems is not at all infrequent. So also occasional explosions are reported from public service tunnels and underground systems. The same problem presents itself as a result of gas mixtures which accumulate from various causes in closed vaults containing control apparatus, electrical or otherwise, in transformers and in similar apparatus.

Nature of Explosive Gases

The gases accumulating under these conditions may arise from a variety of causes. In general, however, they are essentially hydrocarbons (principally CH_4 and related compounds), with occasional admixtures of hydrogen and carbon monoxide. Thus the accumulation in sewers may be CH_4 from fermentation or, at times, gasoline vapors. In the case of other underground systems in streets, there is some possibility of the accumulation of gasoline vapors or of illuminating gas from adjoining mains or, in unusual cases, gases arising from the accidental destruction of the organic insulating materials commonly used. In systems where considerable quantities of lubricating or insulating oil are used, a slight accumulation of explosive vapors may arise from these materials themselves.

A similar problem presents itself in the gases accumulating in mines which resulted in authoritative and exhaustive research by the Bureau of Mines on this subject. Here the quantities of gas are so enormous and the spaces to be controlled are so vast that little can be done beyond obtaining the best possible ventilation. In more limited spaces, however, some preventive measures have been taken, such as the use of fire-snuffing vapors, chloroform and carbon tetrachloride; but these measures have been rewarded with only a limited amount of success. The use of CO_2 to dilute the explosive mixture below the explosion point has been suggested, but this requires an entirely impracticable amount of CO_2. Moreover, one of the essential requirements to obtain safety is occasional attention only; and under these conditions the use of CO_2 becomes unsatisfactory.

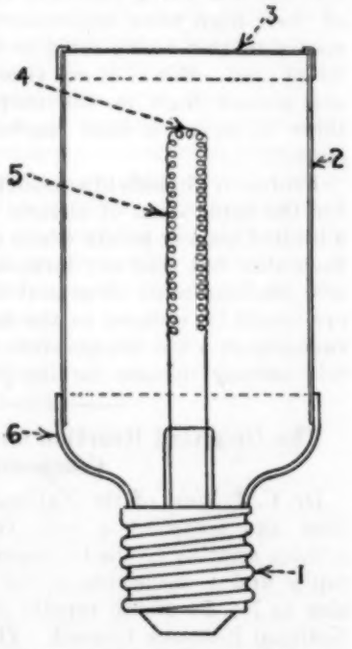


FIG. 1—OUTLINE DIAGRAM OF LAMP

The method to be described here eliminates the danger of explosion by continuously removing the explosive mixture itself—that is, by burning it up more rapidly than it can accumulate. In order to do this the gas must be oxidized at a temperature considerably below that at which the explosive wave is propagated—that is, below the explosion point. It has been possible to do this by the use of an oxidative catalyst finely distributed over a porous surface. A description of the principle of this operation, and some of the results attained, follows:

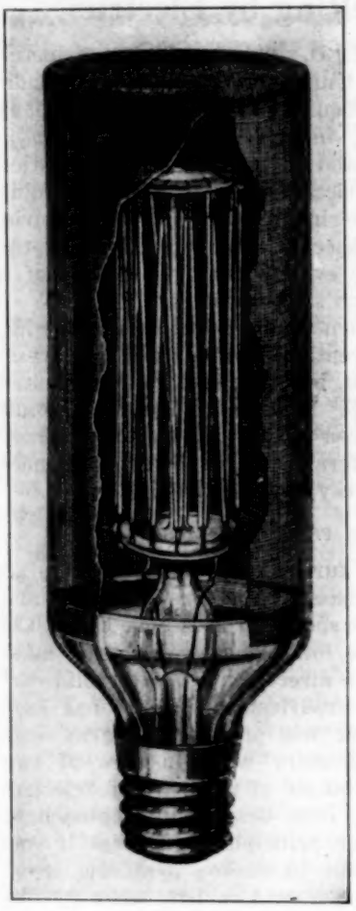


FIG. 2—LAMP WITH SECTION OF WIRE SCREEN CUT AWAY TO SHOW FILAMENT

In the diagram, 1 is a lamp base of the ordinary type which may be screwed into any ordinary lamp socket for the purpose of making connection with a 110-volt circuit. The leads are brought in from the base in the standard fashion through a glass insulating member; 6 is a glass member supporting 2 and 3; 2 and 3 consist of a fine mesh wire screen which is intended to prevent any flame which may form in the interior from striking through to the outside, according to the well-known Davy principle. As a matter of fact, the device is so designed that the possibility of formation of a flame in the interior may be neglected. The bulk of the results described in the succeeding were obtained with the bare and unprotected filament, and the wire gauze is in the nature of additional security. The filament itself, 4 and 5, is shown in the diagram in the simplest form of a coil. In practice there are a number of variations more suitable for special purposes, either consisting of a solid porous cylinder internally heated or of wires sheathed in porous tubes and arranged to form a hollow cylinder.

The essential feature in the whole device is the application of a catalyst to a considerable porous surface, and the control of the resistance of the whole system so that it normally takes on a safe and effective operating temperature. The temperature we have found most satisfactory to use has been between 600 and 800 deg. C. using a platinum catalyst. The best temperature of operation depends somewhat on the catalyst used and the results have varied with various compositions used as catalysts. For this discussion the results with platinum may be taken as typical.

Results Obtained With Platinum Catalyst

The following results give the temperatures (measured by the optical pyrometer) necessary to explode a mixture of 10 parts of air to 1 of natural gas.

Time	Amperes Through Lamp	Deg. C.	
10 min.	1.00	925	No explosion
5 min.	1.05	955	No explosion
20 sec.	1.10	995	Exploded
.....	1.15	1,080	Immediate explosion

These tests were repeated with the natural gas in various mixtures, and the results uniformly showed that under these conditions, filament bare and unprotected, a temperature of nearly 1,000 deg. C. was necessary to produce explosion.[1]

With these preliminary results at hand, the next set of determinations had to do with the operating efficiency of the device as a gas consumer.

RATE OF GAS CONSUMPTION. BARE WIRE, NO CATALYST

2,500 c.c. Air. 250 c.c. Natural Gas

Time	Filament Temp., Deg. C.	CH_4 Burned Per ½ Hr., Per Cent
2½ hr.	780	4
½ hr.	850	11
½ hr.	940	26
2 min.	940	.....
2 min.	960	62 (no explosion)
½ min.	1,000	.....

Results With Other Catalysts

A further series of experiments was carried on to determine the effect of a number of well-known oxidation catalysts. These were carried out by running up the temperature for each catalyst and determining the rate of gas consumption at successive steps 400, 500, 600 and 700 deg. C. Detailed discussion of these results is reserved for some future date. It may be said, however, that while the order of effectiveness did not change essentially for the various catalysts, certain catalysts were relatively more effective than others at low temperatures—that is, change in temperature did not affect all catalysts to the same degree. Further work is needed to discuss this phase satisfactorily.

As examples of the final results obtained, the following values are given:

RATE OF GAS CONSUMPTION. COVERED WIRE + CATALYST

2,500 c.c. Air. 250 c.c. Natural Gas

Catalyst	Time	Filament Temp., Deg. C.	CH_4 Burned Per ½ Hr., Per Cent
Ca-Cr	½ hr.	700	80.4
Pt (A)	½ hr.	700	93.0
Ba-Mn	½ hr.	700	78.0
Pt (B)	½ hr.	700	97.0

The best of these results shows that with the volumes as given, 97 per cent of the combustible constituent, methane, of a mixture in the proportions for complete combustion and highly explosive, can be burned out in ½ hour. The temperature at which this is possible is about 300 deg. C. below the ignition point.

Of course a similar result could be attained at the expenditure of greater time and at a lower temperature. However, throughout an extended series of tests with numerous gases and a variety of lamps, we have never obtained ignition of the most highly explosive vapors and we consider 700 deg. a safe temperature for the device as constructed.

Results With Various Gas Mixtures

Some of the results obtained[2] at various times, based on 5 cu.ft. of gas, or 136 liters, and using the lamp of the most effective type have been as follows:

Pittsburgh natural gas	.6%	91.4 air	43% in 24 min.
Rich coal gas	8.6%	91.4 air	40% in 24 min.
Lean coal gas	10.0%	90.0 air	57% in 24 min.
Hydrogen	10.0%	90.0 air	56% in 10 min.
Hydrogen	15.0%	85.0 air	76% in 10 min.

The astonishing result is that the device functions even in a 10 or 15 hydrogen air mixture. This is probably the most severe test that could be made. The rate of consumption is enormously increased in this mixture, as may be noted. For mixtures of air and hydrogen (submarines and the like) we recommend a type specially designed for this purpose.

In conclusion it may also be stated that when actively functioning in an explosive mixture, the temperature of the filament is somewhat higher due to the heat of reaction. This is readily discernible and the temperature drops again when the combustible gas is exhausted, giving a qualitative indication of the presence of explosive vapors. By the use of a thermocouple junction this indication may be made to be self-recording and capable of accurate measurement.

[1] An exhaustive study on the temperatures of glowing wires necessary to explode various gas mixtures is found in Bureau of Mines Bulletins 52 and 131, Tech. Papers 23, 28 and 75.

[2] For a number of the determinations on various gas mixtures we are indebted to the courtesy of the Pittsburgh Station of the U. S. Bureau of Mines.

Use of Oxygen in Metallurgical Operations

Use of oxygen in connection with the enrichment of the blast in the blast furnace and in practically all phases of pyrometallurgical work will furnish the key to success in the further development of such metallurgical operations, according to Dr. F. G. Cottrell, formerly director and now consulting metallurgist of the United States Bureau of Mines, who first directed the bureau's attention to this subject. Through this enrichment process, it is hoped to increase the efficiency of metallurgical operation with a resultant production of metals at lower cost and possibly the use of lower grade ores.

The Bureau of Mines now has outlined plans for two studies which will be carried on simultaneously. The first will cover the present-day processes for the production of oxygen, in order to determine the feasibility of attempting to produce oxygen, or oxygenated air, in such amounts and at such a cost as to permit of its use in metallurgical operations. The second study will be devoted to the feasibility of using oxygen, or oxygenated air, in metallurgical operations.

Because of his interest in this investigation, M. H. Roberts, vice-president of the Franklin Railway Supply Co., was asked to select an advisory committee to work with the Bureau of Mines, and to act as chairman of this committee. The committee will consist of Dr. F. G. Cottrell, director of the Fixed Nitrogen Research Laboratory; Prof. W. L. DeBaufre, chairman of the mechanical engineering department of the University of Nebraska; Dr. D. A. Lyon, chief metallurgist of the Bureau of Mines; Dr. R. B. Moore, chief chemist of the Bureau of Mines; Dr. R. C. Tolman, professor of physical chemistry and mathematical physics, California Institute of Technology; J. W. Davis, mechanical engineer of the Bureau of Mines; F. W. Davis, metallurgist of the Bureau of Mines; Frank Hodson, president of the Electric Furnace Construction Co., and P. H. Royster, assistant metallurgist of the Bureau of Mines.

Previous to the war, some work was done in Belgium on the enrichment of the blast with oxygen in connection with the smelting of iron ores in the blast furnace.

Synopsis of Recent Chemical & Metallurgical Literature

Nitrogen in Iron and Steel

A review of methods for determining nitrogen in steel and cast iron and a comparison of the amounts of nitrogen found by previous investigators in the several classes of irons and steels are given by F. Wüst and J. Duhr.[1] Further on in their report they give a modification of the usual method of analysis for nitrogen, describe the preparation of a number of nitrides, and give the results of an investigation of the amount and the behavior of nitrogen in iron during the puddling process and in open-hearth, electric and bessemer steels.

All reliable methods for determining nitrogen in steel yet found depend on the conversion of the nitrogen to ammonia by the action of a suitable solvent. This ammonia, recovered from the solution by distillation with an alkali, is determined by a colorimetric (Nessler) or a titrimetric (alkalimetric or iodometric) method. The Nessler method was condemned by Wüst and Duhr because the color of the Nesslerized distillate is modified by the amines during the solution of cast irons. In the analysis of cast irons it was also impossible to determine satisfactorily the end point in the iodine titration. A very sharp end point and satisfactory results were obtained by titrating the ammoniacal distillate with 0.01 normal sulphuric acid using an ether solution of iodeosin as the indicator. Thirty c.c. of this indicator solution is shaken in a 250-c.c. flask with the ammoniacal distillate. Two layers separate, the lower one colored a deep rose. This color fades on titrating with sulphuric acid and is completely lost with the slightest excess. Results for nitrogen in cast irons were from 50 to 100 per cent higher by the iodometric titration than by the iodeosin method. Hydrocarbons which interfere in the iodine titration are shaken out in the ether layer in the new method and thus do not influence the results.

Nitrides of several metals and ferroalloys were prepared by heating the finely powdered materials in N at 900 to 1,025 deg. C. for a number of hours and the product analyzed by the iodeosin method. Results are given in Table I.

TABLE I—ABSORPTION OF N_2 AT 900 TO 1,025 DEG. C.

Metal	N_2 by iodeosin method
Pure Fe	0.02 per cent
Pure Cr	9.81 per cent
Mn (97 per cent)	6.60 and 7.36
Ni	none after 3 hr.
Mo	none after 6 hr.
47 per cent ferrochromium	0.92
86 per cent ferromanganese	0.78
25 per cent ferrotitanium	1.52
10 per cent ferro-aluminum	more than 3
25 per cent ferrovanadium	more than 1
83 per cent ferrotungsten	0.0118
22 per cent ferrophosphorus	0.0179

Wüst and Duhr conclude with an investigation of the amount and behavior of nitrogen in wrought iron, and open-hearth, electric and bessemer steels. Nitrogen in puddled iron increased in proportion to the duration of the heat. The pig iron charge of the heat for which complete data are given contained 0.0009 to 0.0013 per cent nitrogen, while the finished material held from 0.003 to 0.004 per cent.

The changes in nitrogen content during the progress of open-hearth and electric induction furnace heats are traced for one heat of ingot iron, five heats of carbon steel and three heats of chromium steel. Each of these steels was made by a duplex process—a preliminary refining in an open-hearth furnace by the Talbot process, followed by the final refining in a Röchling-Rodenhauser induction furnace. The nitrogen content of the metal of the bath at the start of the open-hearth refining period was about 0.002 to 0.003 per cent in all heats. At the close of the open-hearth refining the nitrogen content was approximately the same as at the beginning, although in some of the carbon steel and chromium steel heats the nitrogen value had passed through a maximum during the progress of the heat and then fallen off to its original value.

During the electric furnace refining the nitrogen in the ingot-iron heat increased slightly to a final value of 0.004 per cent. The nitrogen content of the carbon and the chromium steels increased very considerably during the electric furnace refining; the plain carbon steels finished with 0.009 to 0.012 per cent and the chromium steels with 0.005 to 0.008 per cent N. In heats selected as typical by the authors, plotting the nitrogen content of the bath against the duration of the heat shows very strikingly the influence on the nitrogen content of the various additions to the bath. Recarburization with coke at once increased the nitrogen content of the bath five or six fold—for example, from 0.002 to 0.010 or 0.012 per cent. Additions of a lime-clay-fluorspar slag mixture decreased the nitrogen content, but the subsequent addition of ferrosilicon near the close of the heat again raised the nitrogen content to nearly or quite its maximum value for that heat.

The behavior of nitrogen in basic bessemer practice was determined in about ten heats from each of six different works. From each heat were taken samples of the charge, of the steel before deoxidation, after deoxidation, and after the casting of the last ingot. The nitrogen in the pig iron charge was from 0.0007 to 0.0013 per cent. The steel before deoxidation contained from 0.0109 to 0.0210 per cent nitrogen, and this value was not changed by deoxidation by either solid or liquid deoxidizers.

Qualitative tests for nitrogen in iron as cyanide were negative. The theory that silicon may be a nitrogen carrier in iron does not seem to be correct, or there would be higher nitrogen in acid than in basic bessemer metal, a condition which is not in accordance with fact. From their success in introducing nitrogen into pure iron by heating in nitrogen gas at 900 to 1,100 deg. C., as well as from further successful attempts at nitrogenizing charcoal iron and basic bessemer pig iron by leading dry nitrogen through the molten metal, Wüst and Duhr conclude that in the bessemer blow, nitrogen from the air blast unites directly with the iron.

[1] *Mitteilungen* aus dem Kaiser-Wilhelm-Institut fur Eisenforschung, vol. 2, pp. 39-57; reviewed at length in *Stahl und Eisen*, Aug. 17, 1922, pp. 1290-6.

A Novel Salvaging Operation

The *Hercules Mixer* for September, 1922, describes the novel method used for wrecking four of the sulphuric acid-concentrating units. The building contained five lead pan concentrating units which were used during the war for the concentration of denitrated sulphuric acid. It was decided to tear down four of the units and the building which housed them. Accordingly, the structure was cut away between the fourth and fifth units and a ¾-in. steel cable approximately 200 ft. long was attached to a roof truss. The other end of the cable was attached to a steam locomotive, and after two or three attempts the building gave way and collapsed.

The lumber was used as fuel under the nitric acid retorts. The nitric acid plant happened to be located near to the old sulphuric acid recovery building, so a portable saw was set up near the wreckage and the lumber sawed up into suitable lengths for use in the nitric acid furnaces.

Feldspar Production in New Hampshire

A recent report of investigations of the Bureau of Mines by Raymond B. Ladoo describes one of the important recent developments in the feldspar industry—namely, the rapid rise of New Hampshire as a feldspar-producing state. The unusual size and purity of the deposit now being worked in Keene and the improved methods of mining and milling used have been responsible for this situation. In the spring of 1921 the Keene Mica Products Co., of Keene, N. H., began the production of feldspar from its property in Gilsum, N. H., which had long been operated as a mica mine. The purity of the feldspar at once attracted favorable attention and the production of crude ore rapidly increased. The feldspar is pure and

shows little or no evidence of alteration. It occurs in large crystals and masses with relatively small quantities of crystallized quartz. There is little or no graphic granite or intergrowth of feldspar and quartz. The quality of the feldspar is altogether unusually good.

Milling Operations

The crude ore is unloaded on the floor of the mill and shoveled into a 9x6-in. manganese steel jaw crusher of a special type, which in one operation will crush large lumps to about ⅜-in. size. The ground material is raised by means of a bucket elevator to a 35- to 40-ton bin, and delivered to a disk feeder to a Hardinge mill. The finely ground material is conveyed by a bucket elevator and a short belt conveyor to a 14-ft. Emerick air separator. The fine material is conveyed to a railway car or to storage while the oversize material is returned by a belt conveyor to the disk feeder. The estimated capacity of the plant is 1½ to 2 tons per hour. The success of this method of milling following the general method outlined by the Bureau of Mines offers definite proof that feldspar can be ground continuously and sized by air separation, at the same time making a better product, at a lower cost than is common in batch grinding in "dump cylinders."

Recent Chemical & Metallurgical Patents

American Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Tanning Extract From Quebracho and Waste Sulphite Liquor—Quebracho extract is completely soluble in waste sulphite liquor yielding a liquor which has a tanning value somewhat in excess of the sum of the tanning values of the components. This liquor differs materially from sulphited quebracho extract prepared with the aid of sodium sulphites, as the fresh waste liquor contains only a trace of free sulphurous acid or sulphites. The waste liquor is used just as discharged from the digestor—that is, in the form which is usually called light liquor to distinguish it from evaporated preparations. Various efficient tanning agents can be made from the light liquor by concentration and by other treatment, but the light liquor as it comes from the digestor and without treatment has but little tanning value. If further acidulation of the light liquor is desirable, commercial sulphonic acids containing an aromatic group appear to function better than most other acids. As an example of the preparation of extracts according to this specification, 5 per cent of a sulphonic acid is added to a mixture of equal parts by weight of commercial quebracho extract and light liquor. Upon warming, a clear extract is obtained which can be diluted as desired with water without precipitation of tans. (1,430,477. John K. Tullis, of New York, N. Y., assignor to Fulcra Tan Co., of Irvington, N. J. Sept. 26, 1922.)

Chlorination of Gaseous Hydrocarbons — An essential feature of the invention consists in effecting the chlorination of the hydrocarbons in the gaseous phase and under anhydrous conditions, and thereafter isolating from the reaction mixture the unchanged hydrocarbon, the chlorine derivatives thereof, and the halogen acid, or some of them, by liquefaction methods comparable to those applicable for the separation and recovery of the components of air or other mixtures of so-called fixed gases. (1,422,838. George O. Curme, Jr., assignor to Carbide & Carbon Chemicals Corporation. July 18, 1922.)

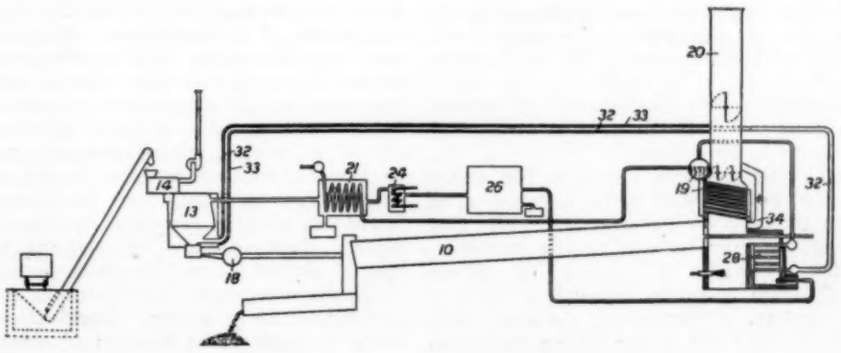
Tanning With Pyrophosphates and Alum—In tanning with solutions containing sodium pyrophosphate, alum and salt, as described in U. S. Pats. 1,039,150 and 1,191,527, it has been found that successful commercial operation requires careful regulation of the temperature, preferably between 95 and 105 deg. F. Exposure for any length of time to temperatures above 107 deg. F. causes deterioration, the leather lacking tensile strength and becoming more or less brittle or "grain-cracky." (1,427,221. Ernest Wyndham Merry, of Sheffield, England, assignor by mesne assignments to Pyrotan Leather Corporation, of Wilmington, Del. Aug. 29, 1922.)

British Patents

For complete specifications of any British patent apply to the Superintendent, British Patent Office, Southampton Building, Chancery Lane, London, England.

Cement—The apparatus described comprises a kiln plant and a process for operating it, in which the firing of the kiln is effected by the coke residue from a carbonization plant working in conjunction therewith. In one form of apparatus, the waste gases from the rotary kiln 10 are utilized in a low-pressure boiler 19, the steam from which is passed to an independently fired superheater 28, and thence to a continuously operating low-temperature distillation retort 13 having a fuel preheater 14. The gas from the retort is passed through a condenser 21, acting as a feedwater heater for the boiler, a cooler 24, and byproduct recovery plant 26, and may then be used for firing the superheater 28 and supplying additional heat to the boiler 19 when required. The solid residue from the retort is pulverized while still hot, and is fed to the kiln by the fan 18. When additional fuel is required for the kiln, the powdered residue, with or without other powdered raw fuel, is mixed with the residual oils from the gas and fed to the kiln in colloid form. The waste gases from the kiln may be bypassed round the boiler through the flue 34. The steam pipe 32 leading from the superheater to the retort is jacketed by a flue 33, through which waste gases from the chimney 20 are passed to a jacket round the retort and thence to the preheater 14. In a modified form of apparatus the boiler and superheater are independently fired and the waste gases of the kiln are utilized for heating the feedwater only. The hot gas from the retort is passed through three heat interchangers in series which act respectively as a feedwater heater, a vaporizer and a superheater, and the steam from the last is passed to the superheater in connection with the main boiler. (Br. Pat. 181,811. E. G. Weeks, Northumberland. Aug. 16, 1922.)

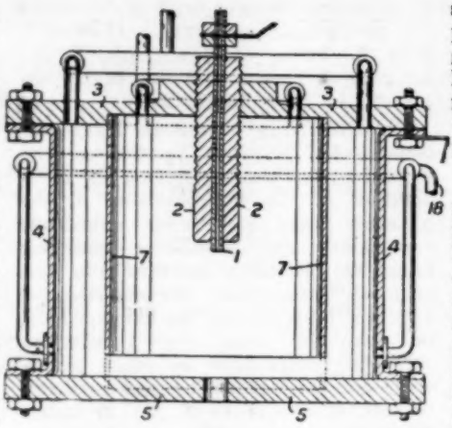
Metallic Powders—Metallic powders for industrial and decorative purposes are obtained by electrolysis using an anode of the required metal, the current density being chosen so that the metal is deposited on the cathode in a finely divided, non-coherent and non-adherent crystalline form; the electrolyte is passed rapidly between the electrodes so as to carry away the powder, and then passes through a separator and, if necessary, a regenerating vat, from which it is returned to the cell or cells by a pump. The current density may be 20 amp. per sq.ft., and the electrolyte velocity 10 ft. per sec. The electrodes may be ⅛ in. apart. The cathode may be of aluminum or copper and may be stationary or may revolve or reciprocate. The powder may be separated from the electrolyte centrifugally or by levigation or filtration, and is washed, dried and, if necessary, polished. In obtaining bronze powder from scrap metal, the electrolyte may be a saturated solution of copper sulphate together with sulphuric acid. Thirty-six cells in series are used, with a current of 1,000 amp. and a pressure of 36 volts. A 50-volt generator is used, driven by a motor which also drives the pump



and the washer, polisher and drier. (Br. Pat. 181,831. W. M. Gillespie and P. Buckley, London. Aug. 16, 1922.)

Bleaching Powder — Compounds of calcium hypochlorite and calcium hydrate are stabilized by washing to remove calcium chloride and by subsequent drying at temperatures up to 110 deg. C. either *in vacuo* or at ordinary pressure. The products thus prepared, which comprise compounds containing 1 to 4 molecules of calcium hydrate in combination with one molecule of calcium hypochlorite, are stated to possess various advantages over ordinary bleaching powder, in that they remain almost unaffected at elevated temperatures at which bleaching powder would be decomposed, have a higher percentage of available chlorine and possess only a faint smell. In an example, 1 cu.m. of chlorinated milk of lime containing 145 grams of available chlorine per liter is stirred with 60 kg. of calcium hydrate, after which 128 kg. of moist salts is separated from the mother liquor. The product, after drying at an elevated temperature, weighs 100 kg. and contains 42 per cent of available chlorine. In another example, a lime sludge containing 100 parts of quicklime and 250 parts of water is chlorinated by stirring in a closed vessel until 85 parts of chlorine have been taken up. The product is freed from the calcium chloride mother liquor and the pressed cake dried in a steam drying oven. The product contains 50 per cent of available chlorine and in this case contains the compound comprising one molecule of calcium hydrate in combination with one molecule of hypochlorite, in addition to that containing twice this quantity of hydrate. The proportions of calcium hydrate and chlorine may be varied so that other products of higher basicity or, on the other hand, mixtures of basic hypochlorite with neutral hypochlorite may be produced, as desired. The compounds are suitable for use in bleaching and disinfecting. (Br. Pat. 182,921. Chemische Fabrik Griesheim Elektron, Frankfurt-on-Main. Sept. 6, 1922.)

Electrolysis—Various products are obtained by the action of nascent oxygen or its equivalent, such as a halogen, produced at an anode having a very small active area compared with that of the cathode, current being supplied at such a pressure that the anode becomes hot, preferably incandescent. Substances to be treated are supplied to the electrolyte or introduced at the anode in dissolved or gaseous form. The substances may be fed through the tubular anode, of which only the end is exposed to the electrolyte. As shown, the anode 1 is surrounded, except at the ends, by a porcelain sheath 2. Instead of a single aperture, the anode may be provided with a number of small holes for the passage of the gas, etc., or may have a porous surface—for example, a coating of silver, platinum, osmium, iridium, carbon or graphite. Alternatively, the anode may be a solid rod, other means for introducing the reagents being provided. Platinum, graphite, lead, silicon and silicon alloys are suitable anode materials. The cathode may consist of the cell wall 4, of compressed carbon or other material and provided with flanges to which are bolted a base 5 and cover-plate 3, which may be of vulcanite, glass, asbestos, etc. A cylindrical diaphragm 7 of earthenware, fireclay, cement, asbestos, etc., extends from the cover nearly to the base, or in some cases into a groove in the base. An overflow 18 leads to a pump, which may return the electrolyte to the anode. Separate circulation of anode and cathode liquids may be provided for. Gases escape at atmospheric or reduced pressure. Under some circumstances intermittent heating of the anode may result from the alternate generation and absorption of gas. Oils from lignite, etc., may be oxidized to fatty acids by introduction through the anode, say in the form of an emulsion in concentrated solution of sodium bisulphate or bichromate, the electrolyte containing bisulphate with or without persulphates. Oil from Caucasian petroleum, emulsified with dilute sulphuric acid, may be treated in the presence of an electrolyte containing sulphuric and hydrochloric acids and sodium bisulphate or perchromates. Naphthene sulphuric acids and carboxylic acids are obtained. Oxygen may be supplied to the anode with the emulsion. If nitric acid is used instead of sulphuric acid, adipic acid is obtained. Substances resembling montan wax can be got by heating lignite under pressure with caustic alkali solution, mixing the product with sodium perchlorate solution and introducing the mixture into the electrolytic apparatus, which may be kept hot so that the wax can be run off in liquid form. Nitrates may be obtained by passing nitrogen-oxygen mixtures through multiple perforations of the anode into the electrolyte, containing a chloride or other salt of aluminum, magnesium, calcium or barium, with or without a salt of chromium, tungsten, or vanadium. Resin oils may be converted into resin acids. Methane may be oxidized to methyl alcohol, formaldehyde or formic acid, the electrolyte in this case, according to the provisional specification, being a concentrated solution of potassium permanganate containing 10 to 20 per cent of chloride of iron. Acetylene gives acetaldehyde and acetic acid. Hydrocarbons can be chlorinated, or nitro compounds obtained. (Br. Pat. 181,848. G. Plauson, Hamburg. Aug. 16, 1922.)



Tungsten Electrolysis—Tungsten or molybdenum trioxide or the corresponding hydrated oxide is reduced to a lower oxide in an electrolytic cell the cathode of which is immersed in a paste of the powdered oxide and an electrolyte such as dilute sulphuric acid in which the oxide is insoluble. A suitable composition for the paste is 900 grams of tungsten trioxide to 150 c.c. of dilute sulphuric acid of specific gravity 1.2. The paste may be contained in a porous pot, and may be agitated by a metal ring connected by spokes to a central rod. The cathode consists of about thirty thin rods of nickel-chromium alloy connected at the top to a metal plate through which the agitator rod passes. The anode may be of lead and may be inclosed in a porous pot containing scrap molybdenum which is oxidized during the process. The cathode paste may contain zinc sulphate or other soluble salt of a metal more oxidizable than tungsten or molybdenum. A current of 30 amp. at 6 volts, rising to 7 volts during the process, may be used, the current density being 0.10 amp. per sq.cm. at the cathode and 0.28 amp. per sq.cm. at the anode. The temperature is maintained between 40 and 60 deg. C. The reduced paste is washed to recover the acid and to remove impurities and then dried on a vacuum filter. The powder obtained may be reduced to metal by heating in a current of hydrogen, the product being obtained in a finely divided state; it may then be pressed into rods or bars and sintered. (Br. Pat. 181,837. R. E. Pearson and E. N. Craig, Hanwell. Aug. 16, 1922.)

Casein—Casein is prepared for use as a plastic material by dissolving it in a solution of sodium or potassium carbonate, sodium silicate, borax or ammonia, adding coloring matter to the solution if desired, and precipitating the casein with the reagent described below. The precipitate is worked up by heat into the desired forms and hardened with formaldehyde. The precipitating agent is made by dissolving zinc sulphite, potassium or sodium meta-bisulphite, glacial acetic acid and alcohol in water, adding zinc cuttings, decanting the clear liquor, treating this with milk of lime and filtering. (Br. Pat. 183,972. R. H. Abrey, London. Sept. 27, 1922.)

Benzanthrone Derivatives — An hydroxybenzanthrone is obtained by heating benzanthrone under pressure with caustic alkali solution in the presence of anthraquinone, with or without addition of a chlorate or nitrate. An aminobenzanthrone is obtained by heating the hydroxy compound with strong ammonia under pressure. (Br. Pat. 183,351. British Dyestuffs Corp., Ltd. Sept. 13, 1922.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields
Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Coal Commission Faces Broad Problems

Lack of Coal Specialists Delays Completion of Staff

As the President's Coal Commission draws nearer to the mountain of work which it has been assigned to do, the commissioners are receiving a new impression of the enormity of the task and the very short time at their disposal. At a time when every hour is precious, they are experiencing exasperating delay in obtaining the technicians for their staff. It has become very evident during the past week that there is no surplus of coal specialists in the country. As a result, the commission is being forced to attempt to draft some of the trained men in the employ of the interests concerned. Due to the limited time and the large amount of work to be done a comparatively large staff of trained men must be put to work. There is a feeling that mine operators, the United Mine Workers, the exporters and the large consumers of coal should be willing to contribute to the success of the commission's work by being willing to make some sacrifice in the way of releasing specially qualified members of their own staffs.

Scope of Investigation

An idea of the task that is facing the members of the commission may be obtained from some of the alternatives between which they must choose. One of the most important questions the commissioners will have to consider is whether or not they will recommend amendments to the anti-trust statute which will authorize consolidations and permit of a scheme of collective marketing.

While it is possible that the commissioners may avoid a flat recommendation as to the rates of wage which they may regard as fair, it is certain that they must go deeply into the wage and living cost questions. In their report they will be expected to discuss and express opinions on such questions as a minimum wage, a guarantee of employment, and unemployment insurance.

It is not unreasonable to suppose that they will consider the place of trade unions in the business of coal production, especially when the organization of coal miners exerts such an important influence on the production of two-thirds of all the coal produced in the United States, which is incidentally nearly half the world's output. The commission is called upon to probe deeply into the affairs of the strongest labor union in the world.

While nationalization is specified as one of the points on which the commission must report, it is regarded as probable that it will be dismissed without extended discussion, although it is probable that the commission will see in the cry for nationalization a reflection of the course which the public instinctively pursues when called upon to pay unusual prices as a result of manipulations for which it is in nowise responsible.

Another big question with which the commission must wrestle is that of regulation. The commission will be expected to express its opinion as to whether or not coal falls into a public utility category.

Need of Feldspar Association Recognized

As the result of a preliminary conference and sounding of sentiment, a meeting of feldspar producers and grinders will be called to be held at the same time and place as the annual convention of the United States Potters' Association to form an organization for general handling of mutual problems and advancement of the industry. It is probable that the meeting will be held in Washington in December.

Standardization is an outstanding problem in the feldspar industry, it is pointed out, as at present there are wide variations of grades nominally identical. It is believed that an agreement on this point can be worked out satisfactorily only through an association, co-operating as a unit with the consumers.

Those interested in the organization of a feldspar association also declare that proper co-operation would bring about a wider market by a close study of the amount of quartz which may be left in the prepared product without injury and by means of interchanging soda feldspar and potash feldspar. It also is felt that by organized effort a wider field of usefulness for the product, which now is consumed principally in pottery and enameled ware, could be found.

The more important producers and grinders of feldspar in the United States number at least seventy. The principal production is along the Atlantic coastline, from Maine to Georgia, with some production in California and a little in Colorado.

Bureau of Mines and A.E.S. Co-operate on Research

At the recent meeting of the American Electrochemical Society in Montreal an advisory committee was appointed to consult with the Bureau of Mines on its electrometallurgical research work and to recommend to the bureau lines of research and investigation. The membership of the committee is made up of the following, who are also members of the Electrothermic Division of the American Electrochemical Society: Robert Turnbull, chairman; J. A. Seede, Dorsey A. Lyon, F. W. Brooke, E. L. Crosby, Acheson Smith, Colin G. Fink and C. A. Schluederberg.

The bureau will send monthly progress reports of its electrometallurgical work to the members of this committee. Among the suggestions for research work which the committee has already made to Dorsey A. Lyon, chief metallurgist of the Bureau of Mines, are: Specific heats at different temperatures; refractories; expanding of refractories; and spalling of refractories.

Joint Meeting of Ceramic Societies Scheduled for December

The New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society will hold an annual convention in the assembly room of the new Ceramics Building, Rutgers College, New Brunswick, on Dec. 12, with morning and afternoon sessions. An interesting program of technical and practical papers is being arranged. A committee has been appointed to perfect details of the gathering, composed of Prof. George H. Brown, director of the department of ceramics at Rutgers College; Abel Hansen, Fords Porcelain Works; LeRoy H. Minton, General Ceramics Co.; Leslie Brown, Lenox, Inc.; Frank R. Valentine, M. D. Valentine & Brother Co.; and George Simcoe, Perth Amboy Tile Works.

American Electrochemical Society Plans Spring Meeting in New York

For the first time in several years the American Electrochemical Society will hold its annual spring meeting in New York City, on May 3, 4 and 5, 1923. Very promising progress is being made on two symposiums: one on the production and application of the rare metals, under the direction of Dr. F. M. Becket, and the other on electrode potentials, under the direction of Dr. William G. Horsch. Headquarters will be at the Hotel Commodore.

More Tariff Jokers Come to Light

Customs Officials Straightening Tangles in Duties on Coal-Tar Products, Molasses and Paper Pulp

Some difficulty has been experienced in working out the provisions of the McCumber-Fordney tariff act dealing with the application of the United States value to coal-tar dyes and chemicals, which are given treatment different to that accorded to other classes of merchandise.

A joint conference among representatives of the Tariff Commission, the United States Bureau of Standards and the Customs Division of the Treasury Department was held in New York, Nov. 2 and 3. Plans were discussed for determining the standard strength of coal-tar dyes in commercial use prior to July 1, 1914, and gathering samples of domestic dyestuffs for comparative purposes for proper administration of the new tariff act.

Chemicals Cause Heavy Work

The conferees also discussed the needs of the laboratory at the appraiser's stores in New York, which is to be enlarged both in equipment and in personnel so as to be able to make the tests which will be required in assessing duties on coal-tar products. Announcement of the appointment of the chief of this dye-testing laboratory is expected to come from the Customs Division within a few weeks. It is planned to give him three assistant chemists and the necessary clerical force.

The chemical work thrown upon the Customs Division because of the two coal-tar products paragraphs of the new tariff bill is heavy. Domestic products must be determined, because the act provides that where there is a comparable domestic coal-tar product, the imported product shall be assessed for duty on the basis of the wholesale selling price of the American product. Non-competitive imports are to be assessed on the basis of United States value.

The basis of assessment also is to be upon the strength in commercial use prior to July 1, 1914. Prior to that date many dyes were imported in single strength which now come in in double, treble or even greater strength. The change in form of imports is particularly true of vat dyes. In the case of dyes coming in with higher strength than in the first half of 1914, the specific duty of 7 cents per pound will be increased proportionately. This will give a "concealed protection" to some domestic dyes not shared by others and is one of the inequalities of the new tariff act.

Molasses Practically Embargoed

An almost prohibitive duty will be assessed against imports of molasses if an interpretation said to have been made by the Treasury Department of the wording of the molasses provisions of the McCumber-Fordney tariff law holds. The intent of Congress apparently is not carried into the language of the provisions, and it is understood that the Treasury Department takes the stand that it has no alternative than to interpret literally Paragraph 502.

9½ Cents per Gallon on Blackstrap

The same situation is found to be present with respect to the latter part of this paragraph dealing with blackstrap molasses. Congress provided a rate of one-sixth of one cent per gallon when testing not above 52 per cent total sugars; testing above 52 and not more than 56 per cent total sugars, one-sixth of one cent additional for each per cent of total sugars and fractions of a per cent in proportion.

On this basis sugars totaling 56 per cent in molasses would take a rate of one-sixth cent per gallon up to 52 per cent, and then along will come the excess rate—56 times one-sixth cent per gallon plus one-sixth cent per gallon; so that the assessment will be 9½ cents per gallon.

Logs for Paper Pulp Erroneously Taxed

Another oddity of the McCumber-Fordney tariff act came to light following complaints to Washington from importers of logs that Collectors of Customs are seeking erroneously to collect duties when the logs are free of duty as pulp wood. Paragraph 1700 provides for the free entry of "wood: logs, timber, round, unmanufactured, hewn, sided or squared otherwise than by sawing; pulp woods. . . ."

The conflicting paragraph is Paragraph 401, "logs of fir, spruce, cedar, or Western hemlock, $1 per thousand feet board measure."

The importers protested to the customs officials at ports involved that this lumber is strictly for pulp wood production uses, and the Collectors are said to have held up the entries awaiting action in Washington as to the methods to be pursued in handling log imports. There is no doubt as to the intent of Congress to place pulp wood on the free list, so that construction is not involved.

Perkin Medal Awarded to M. C. Whitaker

The committee in charge of the annual award of the Perkin medal met last week at the Chemists' Club and selected Dr. M. C. Whitaker, vice-president and general manager of the U. S. Industrial Alcohol Co., as the recipient for 1923. The presentation will be made at a meeting of the American section of the Society of Chemical Industry, Jan. 12, 1923. The medal is awarded annually under the auspices of this organization, having been established in 1906 on the occasion of the visit to this country of Dr. William Henry Perkin of England. He was the first recipient of the medal, which has been awarded annually since that time for conspicuous contributions to the science and industry of chemistry.

Helium Legislation to Be Pushed

Federated American Engineering Societies Emphazises Importance of Early Hearings on Pending Bill

The desirability of conducting hearings at the earliest possible time on the bill providing for the conservation and production of helium has been emphasized in representations made by the Federated American Engineering Societies to the chairman of the Public Lands Committee of the House of Representatives. The legislation has the indorsement of the President and the members of the Cabinet concerned with helium production. The request of the Federated Engineering Societies was to the effect that these hearings begin during the extra session of Congress, should one be called, or if not, that they be undertaken immediately on the reassembling of Congress in December.

Kahn Bill Pending

It is well known that large quantities of helium are daily going to waste. Representative Julius Kahn, of California, has introduced a bill in Congress to support a definite program of helium recovery. This bill is in the hands of the Public Lands Committee. It has the indorsements of the President and Secretaries Denby, Weeks and Fall, and its purpose is to develop the best methods of recovering helium and to collect and store supplies for military and commercial uses. The recent disaster which met the attempted flight of the hydrogen-inflated dirigible C-2 at San Antonio, Tex., again emphasizes the necessity for using a non-flammable gas in balloons.

Progress in Technology

Satisfactory operation on a laboratory scale of a simplified and much cheaper method of recovering helium is reported by the Bureau of Mines. In a test run made within the last month at the cryogenic laboratory in the Interior Department Building, helium was recovered from natural gas in one operation in sufficient purity for use in dirigibles or balloons.

Helium recovery as carried on at government plants in Texas results in a gas of about 64 per cent purity and necessitates a second operation to remove impurities. By the old method the flow from the natural gas wells is directed through a series of compressors which reduce the various gases in the mixture to liquid form. Methane becoming liquid at a higher temperature is taken off first. The remaining gases are then, one by one, liquefied, leaving helium, which has an exceedingly low liquefying point. The difficulty with the old method is to liquefy all the nitrogen.

It is planned to erect a semi-commercial plant and apply the new method to quantity production. The workers have hopes of being able to do in large-scale operation nearly as well as they have done in the laboratory.

A.S.M.E. Plans Big Meeting in New York

Joint Sessions With Other Societies Will Attract Many Engineers

The annual meeting of the American Society of Mechanical Engineers, the biggest of the national engineering gatherings of 1922, will be held in the Engineering Societies Building, New York City, Dec. 4 to 7. At that time John L. Harrington of Kansas City will succeed Dean Dexter S. Kimball of Cornell as president of the society.

A feature of the meeting, which will attract engineers, manufacturers, economists, educators and industrialists from all over the country, will be joint sessions with the American Economic Association, the American Society of Safety Engineers, the American Society of Refrigerating Engineers and the American Engineering Standards Committee.

H. F. Loree, president of the Delaware & Hudson R.R. Co., and E. M. Herr, president of the Westinghouse Electric & Manufacturing Co., will be among the speakers at the economic forum, at which addresses also will be delivered by Dr. W. C. Mitchell of the National Bureau of Economic Research, professor of economics at Columbia University; Prof. H. R. Seager of Columbia, president of the American Economic Association, and Dean Kimball. Mr. Herr's topic will be "The Human Problem in Industry." Professor Mitchell will discuss "Making Money and Making Good."

Subjects for Discussion

The sessions of the professional divisions of the society will cover a wide range of industrial and technical progress, including development in aëronautics. Orville H. Wright is a member of the aëronautics division. Other professional divisions to meet include those devoted to fuel, management, forest products, ordnance, railroads, textiles, gas power, machine shop practice and materials handling. The ordnance division is working with the army authorities to produce better ordnance and eliminate the evils revealed by the war.

Education, described as a question of increasing interest in the engineering profession, will be one of the big features of the meeting, to which representatives from practically all the leading universities and technical schools will come. Notable among the reports to be presented will be that by the committee on training for the industries, covering recent advances in correspondence work in extension schools, industrial training schools, and training in the works.

Student Sections Meet

The American Society of Mechanical Engineers maintains student branches in sixty-two colleges and technical schools, and in connection with the meeting a session planned and directed by students themselves will be held. Research will be a principal topic and several papers telling of its progress will be read. Local sections and branches of the society from fifty-four industrial centers will send delegates to the meeting. Activities of the professional divisions represent 8,970 members. A special program in which women are taking an active part is being arranged.

Other features of the meeting will be public hearings on the society's boiler code, which has formed the basis for laws in eighteen states, and on the power test code; local sections conferences, presidential address and reception, and a business meeting. The opening event will be a meeting of the society's council on Monday, Dec. 4.

New Committee Chairmen

Elections of executive committees to direct the work of the professional divisions during the coming year are announced at the national headquarters of the society in New York. The new chairmen are:

Aëronautic Division, Major Thurman H. Bane, U. S. Air Service, Dayton, Ohio; Forest Products Division, Thomas D. Perry, Grand Rapids, Mich.; Fuels Division, Prof. L. P. Breckenridge, Yale University; Gas Power Division, Van H. Manning, director of technical research, American Petroleum Institute, New York; Machine Shop Division, F. O. Hoagland, Worcester, Mass.; Management Division, R. A. Wentworth, Long Island City, N. Y., Materials Handling, H. V. Coes, Philadelphia, Pa.; Ordnance, Waldo H. Marshall, New York City; Power, John H. Lawrence, New York City; Railroad Division, James Partington, New York City, and Textile Division, Charles T. Plunkett, Adams, Mass.

Delegates to the American Engineering Council have been elected by the society as follows: L. P. Alford, New York City; E. R. Fish, St. Louis; Dean Arthur M. Greene, Princeton; John L. Harrington, Kansas City; Edwin B. Katts, New York City; Fred R. Low, New York City; Fred J. Miller, New York City; S. W. Stratton, new president of the Massachusetts Institute of Technology; and Max Toltz of St. Paul.

Government to Study Recovery of Byproducts From Wool Scouring

With legislation in prospect dealing with the pollution of streams, a more active interest is being manifested in utilizing the byproducts of wool cleaning. The problem is being worked on actively at the Bureau of Chemistry in the hope that means may be found which will make it possible to recover the grease and potash in cheaper and more effective methods than have been tried heretofore.

The Bureau of Chemistry recently made an exhaustive survey of the subject and finds that the average grease content of wool is 15 per cent and that the average potash (K_2O) content is 4 per cent. In some instances the grease content ran as high as 35 per cent and the potash content as high as 6 per cent.

Phosphate Rock Prospects Are Good

Fertilizer Companies Expect Big Year—Hydro-Electric Power Needeed

Development of the potential hydro-electric power of the Duck River, which runs through the northern portion of the phosphate rock fields of middle Tennessee, or the Buffalo, which runs a few miles to the west of the deposits, has been suggested by men in the phosphate rock business in that section. It is thought that the greatest need of these fields at the present time is cheap hydro-electric power. It had been hoped by these interests that the work at Muscle Shoals would be rushed to such an extent that they could get power from that source. They are now looking around, however, for another source for this power.

The phosphate rock mining, crushing and washing in this section have grown to large proportions during the past 2 years, in spite of the small comparative sale of fertilizer during that period. At present 600,000 tons per year are mined and employment is given to 2,000 men.

Most of the rock being mined at present is being shipped to the Northwest for the wheat crops. As soon as these shipments are completed the rock will be diverted to the plants of the various fertilizer companies in the South, to be used in the production of complete fertilizer for next year's crops. It is predicted that fertilizer sales will take a big lead over those of the past 2 or 3 years. This is accredited to the fact that very little fertilizer has been used in the past 2 or 3 years by the Southern cotton farmer, and with the demand for cotton being ahead of this year's crop, the farmers will be encouraged to try to produce larger crops next year.

Recent announcement has been made that the American Agricultural Chemical Co. will erect a large crushing and washing plant in connection with a large tract of proved, high-content rock which it holds near Cleburne, Tenn. Work on this plant is progressing and it is thought that it will be started into operation in time to produce rock for next spring's fertilizer business.

Complaint Lodged Against Varnish Company

The Federal Trade Commission alleges methods of unfair competition in a complaint issued against the Don-O-Lac Co., Inc., of Rochester, N. Y.

The concern is a manufacturer and distributor of paints, varnishes, shellacs and kindred products, and is charged in the complaint with advertising and selling under the name of "American Shellac" a substitute for shellac which is inferior to shellac as commercially known. The trade and the general purchasing public, the complaint avers, is thereby deceived into the belief that the product is composed of shellac gum and alcohol, when such is not the case.

Water-Power Act to Be Defended

Committee Formed to Support Its Provisions, Which Would be Violated by Ford Muscle Shoals Proposal

Declaring that the principles of the federal water-power act passed in 1920 after 15 years of discussion in Congress and of effort by the friends of conservation are under attack from divers quarters and that the law itself is in danger, Philip P. Wells, formerly chief law officer of the U. S. Forest Service and later of the U. S. Reclamation Service, has announced that a national committee for the defense of the act has been formed.

The State of New York has brought suit in the Supreme Court of the United States to have the water-power act annulled. The Federal Power Commission, administrator of the act, is, by a decision of the Comptroller of the Treasury, forbidden to spend the money appropriated by Congress for the employment of experts urgently needed for the proper administration of the act. Congress does not take up the very simple legislation necessary to cure this defect, but has given a vast amount of time to Henry Ford's proposal at Muscle Shoals, which violates every one of the principles of the act and gives to Mr. Ford, in addition, a vast subsidy from the federal Treasury.

Ford Terms a Bad Precedent

If this proposal were accepted by Congress, every corporation which has or desires a water-power privilege would demand a lease on Mr. Ford's terms. And how could they be denied? The acceptance of his offer would be a deadly blow to the application of the principles of conservation to the use of water power.

The water-power act of 1920 embodies those principles, and thereby protects the public interest in obtaining full development without having to pay monopoly profits. It does this by requiring:

(1) That every water-power lease shall be limited to a maximum of 50 years.

(2) That the lessee shall pay the government a small rental for the power privilege when he builds his own dam and other works, and a larger and fair rental when he uses works constructed by the government.

(3) That the lessee must submit to regulation by state authority, or, if there is no state authority, by the Federal Power Commission, of the services he renders and the prices he charges for light and power.

(4) That any excess profits over a fair liberal return on the actual investment shall be made over to the public in the form of a reduced price for the lessee's works at the end of his 50-year term.

(5) That states and cities have first call on power sites.

None of these requirements would be imposed under the Ford offer, acceptance of which by Congress would therefore be practically tantamount to a repudiation of the federal water-power act. That act is at once progressive and practical. It safeguards for all time public rights in the greatest of natural resources, but it is acceptable to investors in and to managers and promoters of water-power enterprises today. It was framed with great care and embodies, perhaps beyond any other law on the statute books, the conclusions of experts in engineering, economics, legislative drafting and constitutional law.

Committee Members

Among the members of the committee which will stand for the support of the act are James R. Garfield of Cleveland, Walter L. Fisher of Chicago and John Barton Payne of Chicago, former Secretaries of the Interior; Henry L. Stimson of New York, Lindley M. Garrison of New York and Newton D. Baker of Cleveland, former Secretaries of War; David F. Houston of New York and Edwin T. Meredith of Des Moines, former Secretaries of Agriculture; Governors Henry J. Allen of Kansas, Joseph M. Dixon of Montana and John M. Parker of Louisiana; Gifford Pinchot, Republican candidate for Governor of Pennsylvania; Henry S. Graves, head of the Yale Forestry School, until recently chief of the U. S. Forest Service; Herbert Knox Smith of Connecticut, former Commissioner of Corporations; William Kent of California, former Congressman, and other prominent conservationists.

Ferro-Alloy Duty to Be Based on Buyers' Analysis

Explaining that commercial sampling of ores and alloys used in the manufacture of steel is an elaborate and expensive process for which the Customs Division has no facilities, the Treasury Department has notified Collectors of Customs to use the determinations made for settlements between buyers and sellers as the basis for collecting final duties on such imports. Collectors are instructed to preserve samples for a checking analysis against the figures of buyer and seller.

The instructions further assert that inasmuch as most of the imported manganese ores contain from 45 to 55 per cent metallic manganese, Collectors are authorized to accept estimated duties on the basis of an average of 50 per cent metallic content.

This ruling disposes of one of the features of the new tariff act which has caused administrative officials much study. The duties on ores and alloys used in steel manufacture are based on the metallic content. Investigation disclosed that accurate sampling would be too expensive for the Customs Division to undertake independently and the decision to accept the settlements between buyer and seller as the basis for assessing duties followed.

German Beet Sugar Industry Fatally Crippled

Germany will never again be able to export 1,000,000 tons of sugar, as it did before the war, according to Alfred P. Dennis, special representative of the Department of Commerce in Europe. Perhaps 10 years from now it may have a surplus of 500,000 tons, but for the immediate future it will have all it can do to supply domestic needs.

Germany for years has been the leading beet-sugar producer of the world. Second place in world production, formerly occupied by Russia, has now been taken by the United States. With production cut approximately in half by the war, the recovery of the German sugar industry is a matter of practical concern to American beet growers and sugar refiners.

For the past seven years Germany has been entirely out of the sugar export trade, and during the last season was under the necessity of importing 150,000 tons or more to cover absolute domestic requirements.

Loss of Beet Lands

Within the territory turned over to Poland by Germany under the terms of the peace settlement were 296,400 acres of beet-sugar land. Indeed, some of the best beet-sugar soil of the old empire was in the Posen region and the so-called Danzig corridor. With the territory there passed also to Polish control two sugar refineries and upward of 30 sugar factories. Experts estimate that 450,000 tons of sugar production has been lost to Germany by territorial cession out of the 2,700,000 tons of pre-war sugar capacity.

Aside from territorial losses, beet growing has been further curtailed in the area now included in Germany, the acreage having fallen in the post-war period about 21 per cent, while yields per acre have fallen off approximately 30 per cent. The two main factors that check rising production are labor difficulties and soil deteriorations.

The deterioration of the German beet-growing soil is connected with reduced imports of oil-cake and phosphatic fertilizers. Experts agree that it will take at least 10 years for the German sugar industry to get back to its pre-war position.

Cuban Sugar Mill Breaks Production Record

Establishing a world record, a Cuban sugar mill has already ground over 350,000,000 pounds of sugar this year to August 31, according to a report received by the Department of Commerce. Indications are that the crop which will soon be finished will amount close to 4,000,000 long tons. During the first eight months of 1922, 1,473,064,829 pounds of sugar valued at $35,059,803 were shipped from Cuba to the United States—about twice the quantity shipped during the same period of 1920 when sugar prices were excessively high. The 1920 sugar was valued at $88,374,248.

Manufacturers to Standardize Fertilizers

Confer With Experiment Station Officials in Chicago on Methods of Reducing Varieties of Product

Reduction of the number of mixed fertilizer analyses for use in Ohio, Indiana, Michigan, Missouri and Wisconsin from the fifty or sixty now marketed to fifteen, involving elimination of low grades, fractional analyses and poorly balanced mixtures, was agreed upon at a conference among agronomists of the five states and representatives of nineteen fertilizer manufacturers doing business in the Middle West, together with representatives of the soil improvement committee of the National Fertilizer Association.

It is expected that this agreement will prove the forerunner of similar action for other groups of states, with resultant benefit to the farmers, by simplifying selection of the proper analyses for certain soil and crop conditions and to the manufacturers by reducing the number of analyses manufactured.

For several years meetings have been held in various states where manufacturers of fertilizer were brought into touch with officials of the experiment stations. These are to be continued.

MANUFACTURERS APPRECIATE RESEARCH

Manufacturers' representatives at the Chicago conference adopted resolutions to direct their sales policy to encourage the sale of the mixed fertilizer analyses recommended by the agronomists above others. The manufacturers also favor state meetings of their traveling salesmen, when they may receive information of experimental work with fertilizers. Another resolution approved the desire expressed by certain state experiment station and control officials to have determined and published the availability of the nitrogen in fertilizers and recommended that reports of availability be expressed as percentages of the total nitrogen present.

State agronomists at the conference were Prof. Firman E. Bear, Ohio State University; Prof. A. T. Wianoko, Purdue University; Prof. M. F. Miller, University of Missouri; Prof. A. R. Whitson, University of Wisconsin, and Prof. M. M. McCool, Michigan Agricultural College.

The fertilizer manufacturers represented were: Alliance Fertilizer Co., American Agricultural Chemical Co., Armour Fertilizer Works, Calumet Fertilizer Co., Darling & Co., Diamond Fertilizer Co., Farmers Fertilizer Co., Federal Fertilizer Co., Groves Fertilizer Works, Hopkins Fertilizer Co., International Agricultural Corporation, Jarecki Chemical Co., Morris & Co., F. S. Roster Guano Co., Smith Agricultural Chemical Co., Swift & Co., Virginia-Carolina Chemical Co., Welch Chemical Co. and Wuichet Fertilizer Co.

SEE MUTUAL ADVANTAGE

Returning from Chicago, where the conference was held, Prof. William D. Hurd, director of the soil improvement committee, predicted mutually beneficial results from the agreement. "The conference was marked by a splendid spirit on the part of both the state officials and representatives of the industry," said Professor Hurd. "The subjects involved were approached with an appreciation of one another's viewpoint and there was much frank and wholesome discussion.

"The state agronomists will now formulate their recommendations for various soils and for best crop conditions, based on the selected analyses. Instead of a multiplicity of recommendations, which are confusing and irritating to the farmer, there will be an unanimity which cannot but increase fertilizer usage, to the benefit of farmer and manufacturer alike."

Fish Oil Factory for British Columbia

The Ferphos Fish Products, Ltd., has been organized at Victoria, B. C., for the purpose of taking over the patents of E. G. Henshall and of building and operating a factory at Skidegate Inlet, Queen Charlotte Island, for the manufacture of oil and fishmeal from dogfish, which abound in the Northern Pacific waters.

For some time past Mr. Henshall has been operating a small experimental plant at Sooke, 20 miles from Victoria, and claims to have demonstrated that, by his process, the whole of the fish can be used and 100 per cent more oil be extracted than by methods hitherto used, and that a better grade of oil is obtained. By the old method oil was extracted only from the liver of the fish and, except in a few instances where the fish was used for fertilizing nearby land, the rest of the fish was wasted. By the old method 50 tons of fish yielded 100 gal. of oil, which sold on an average at 40 cents per gallon, whereas by the Henshall process the same quantity of fish is said to yield 200 gal. of oil and 2,000 lb. of fishmeal, the total value of which is more than $150. Local paint manufacturers have taken all the oil produced at the experimental plant and have pronounced it high grade. The Provincial poultry inspector has indorsed the fishmeal as a suitable food for poultry. The plant at Skidegate Inlet will have a capacity of 50 tons of dogfish per day, and will be thoroughly up to date in every way. The dogfish found in the waters near the inlet range from 10 to 40 lb. in weight.

Propose Fertilizer Payment to German Grain Farmers

According to the official Prussian press service the Prussian Government has proposed to the Reichsrat to pay the farmers the increase in the price of grain quotas in the form of Chilean saltpeter. According to the proposal the 1923 harvest would show an increase of 3 to 4 million tons of grain. Only in this way, says the preamble of the Prussian proposal, can a cheapening of the price of bread in the near future be effected.

Personnel Association to Meet in Pittsburgh

Industrialists, educators and personnel experts representing the country's largest business and manufacturing enterprises will engage in a 3-day national forum, beginning Nov. 8, at Pittsburgh under the auspices of the National Personnel Association. Centering around the numerous discussions, addresses and committee reports, covering a wide range of administrative effort, will be the problem of "the human factor," now of outstanding importance in this and other countries.

The Pittsburgh gathering will mark the first annual convention of the National Personnel Association, which has taken over the activities of the National Association of Corporation Training and the Industrial Relations Association of America. Immigration, psychological tests, motion pictures, pension plans for workers, employment and labor turnover, shop training and the relation of industry to both the engineering and the public schools will be discussed as questions pressing for solution.

The announced purpose of the convention is "to advance the understanding of the principles, policies and methods of creating and maintaining satisfactory human relations within commerce and industry."

NOTED SPEAKERS

Michael Pupin, professor of electromechanics at Columbia University and famous as an inventor for his contributions to the wireless art, will deliver an address on "The Immigrant's Point of View." Professor Pupin, born in Serbia, began life as a shepherd boy, coming to America with a nickel and an apple as his sole possessions. Magnus W. Alexander, managing director of the National Industrial Conference Board, will speak on "Our Immigration Policy and Its Social and Economic Effects." George F. Quimby, industrial service secretary of the Associate Industries of Massachusetts, will discuss "Training Immigrant Workers."

Other speakers will be H. M. Jefferson, Rowland Rogers and Dr. Lee Galloway of New York, Oscar M. Miller, Bayonne, N. J.; Cator Woolford, Atlanta, Ga.; J. W. Dietz, New York; Martin W. Dodge, New York; Harry A. Hopf, New York. Major W. A. Magee of Pittsburgh will address the delegates, for whom social events have been arranged by the Pittsburgh Personnel Association.

Chamber Sulphuric Acid Plant to Be Built for City of Buenos Aires

Considerable interest in heavy chemical circles has been focused on developments in South America during the past year. It is now announced that a contract for a large chamber sulphuric acid plant to be erected by the City of Buenos Aires, Argentina, has been awarded to the Chemical Construction Co., of Charlotte, N. C.

Manufactured Gas Sales Increase Greatly

Growing Use in Industry and New Domestic Appliances Explain Growth

Sales of manufactured gas for 1921 touched a new high figure of 326 billion cubic feet, an increase of 7 billion cubic feet over 1920 and 20 billion cubic feet over 1919, according to the third annual survey of the gas utilities of the United States just completed by the American Gas Association.

Coincident with the compilation of its 1921 figures, the association has also made an analysis of the per capita consumption of gas for the last twenty years. This shows that the per capita increase for the ten-year period 1901 to 1911 was 30 per cent, while for the period 1911 to 1921 it was 80 per cent, showing that the American people during the last ten years consumed nearly three times as much gas per capita as they did during the preceding decade.

One of the principal factors in this increase is said by the association to be due to the growing use of gas in industrial plants during the last ten years. At the present time, the survey shows, about 22 per cent of the total amount of gas sold is used by industry.

Figures showing the domestic use of gas also reveal a remarkable increase. At the end of 1921, according to the association, 46,700,000 persons in the United States were served with gas through 69,500 miles of mains and 9,291,000 meters, the gas being used in 7,040,000 cooking appliances, 1,573,000 water heaters, 1,268,000 space heaters and 8,800,000 incandescent burners. This is an increase over 1920 of 363,000 customers, 314,000 meters, 1,000 miles of gas mains, 370,000 cooking appliances, 150,000 water heaters, and 144,000 space heaters.

Of the total amount of gas sold for the year 1921, 18.50 per cent was for illumination, 56.71 per cent for domestic uses other than illumination, 21.62 for industrial uses and 3.17 for other uses not classified.

Miniature Working Models Will Feature Power Exposition

Among the interesting features which will be displayed at the National Exposition of Power and Mechanical Engineering, at the Grand Central Palace, New York, during the week Dec. 7 to 13, are several elaborate models of modern installations.

As an excellent example of the manner of preparing anthracite coal for the market, the model of the famous Loree breaker of the Hudson Coal Co. will be exhibited. This model, requiring an entire express car for shipment to the exposition, is a replica of the largest breaker in the world, which was erected and put in operation in 130 days and in 1921 handled 591,000,000 tons of coal. This model will show the breaker in operation, crushing the large lumps of coal, sizing it through screens and passing the sized coal through jigs, where the refuse material is separated.

The development of the power station will be illustrated by the exhibition of a series of models of the important central stations in New York City. The original station erected by Thomas Edison in Pearl Street will appear beside the more modern Waterside stations and the recent Hell Gate station. The representation of this latter station is a faithful reproduction built to a scale of one-quarter of an inch to the foot. It shows the steam and electric apparatus in the plant and the various boiler room and turbine room auxiliaries as well as the elaborate machinery for handling the enormous tonnage of coal and ashes.

Rubber Paving Block Is Developed in England

Composition Core With Vulcanized Cover May Be Commercially Practical

A new type of rubber composition paving block has been produced by Wingate & Sutton, 5 Victoria St., Westminster, London, according to a report to the Department of Commerce by Consul Coulter, London, which, it is claimed by the manufacturers, can be placed on the market at a price to compete with the ordinary creosoted wooden block, when the advantages of absence from noise and long life, estimated at 15 years, are taken into consideration.

Two types of blocks have been produced, a No. 1 block, made of the "core" surfaced with a half-inch hard vulcanized rubber, and a No. 2 block, which consists of the "core" only. The principal ingredients of the core, which has been patented, are rubber, jute and china clay. These ingredients enable the whole block to be vulcanized in one piece, and it has been found by experiment that the block should be a solid mass and not made up of separate superimposed portions.

In an experiment of a wooden block upon which a steel plate was placed as a seat for a rubber surface, it was found that the heavy traffic turned up the steel plates at the edges. At St. Pancras Railway station the covered way under the hotel is covered with a sheet of rubber of about ½ in. thickness. It has been found, it is claimed, that there is a tendency for the rubber sheet to "lick up" so that it must be pegged down from time to time. As a result of various experiments, Wingate & Sutton have decided that the separate solid block gives the best results. The block proposed is similar to the wooden block used ordinarily for street paving, and measures 9x4½x3 inches.

Up to the present time it has not been possible to manufacture rubber blocks at under three times the cost of wood paving which is about $5.40 per square yard. The Gould block core it is claimed can be made at about 4 cents per pound and it is hoped that the price of paving will not be more than $13.35 per superficial square yard.

Personal

FREDERICK FRANZ, who for the past 4 years was chief engineer of the Terminal Engineering Co., has opened an engineering office at 27 Warren St., New York City. He will devote attention particularly to labor-saving machinery for industrial plants.

H. A. GARDNER, of Washington, D. C., gave an address on the technology of paints before the members of the Lehigh Valley Section of the American Chemical Society, Allentown, Pa., on Oct. 20.

ALEXANDER LEGGAT, formerly a consulting engineer at Butte, Mont., and previously connected with the engineering department of the Anaconda Copper Mining Co., has been appointed manager at the plant of the Richmond Mining, Milling & Reduction Co., Wallace, Idaho. Mr. Leggat is a graduate of the Houghton, Mich., School of Mines.

Prof. W. A. NOYES of the University of Illinois has been granted a year's leave of absence for study and research in Europe.

Dr. WALTER ROSENHAIN, of the National Physical Laboratory of Great Britain, will deliver the second annual lecture of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. The subject will be some theoretical phase of non-ferrous metallurgy. During his visit in this country Dr. Rosenhain will deliver lectures at Massachusetts Institute of Technology, Yale, Columbia, Case School of Applied Science and Franklin Institute.

Dr. C. G. SCHLUEDERBERG, of the Westinghouse Electric & Manufacturing Co., expects to sail for the Orient late in November and will be away several months. He is president of the American Electrochemical Society.

C. E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Co., has sailed to attend the meeting of the rating committee of the International Electro-Technical Commission to be held in Geneva, Switzerland, beginning Nov. 18. Mr. Skinner organized and directed the research work of the Westinghouse company until his recent promotion to the position of assistant director of engineering. The chief work to be taken up by the committee at Geneva will be to obtain final agreement on the basis of rating of all classes of electrical machinery.

Dr. M. C. WHITAKER, vice-president and general manager of the U. S. Industrial Alcohol Co., New York, has been selected as the recipient of the Perkin medal to be presented Jan. 12, 1923.

WALTER G. WILLARD, field secretary of the Western Petroleum Refiners' Association, resigned Nov. 1.

Market Conditions

In Chemical, Metallurgical and Allied Industries

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities Prevailing Prices and Market Letters From Principal Industrial Centers

Inflation!

What Is It? Is It Coming? How Shall We Know When It's Here?

"How's business?" we asked a chemical manufacturer.

"Good," he replied, "I'd say fine, if I dared, but 1920 isn't so many years ago, and I said fine then."

"I suppose you're afraid of overproducing again?" we queried.

"Man, I'm more than afraid of it. I have cold shivers every time I think of 1920. We are buying from hand to mouth and it will be some time before we change."

That's the principal reason why we don't need to worry about inflation for a while. Very few manufacturers will forget 1920 and 1921 for a while and conservative business policy will probably rule for some time. So we have answered the second question before we have answered the first. Calamity howlers and rising prices in a few lines do not indicate inflation any more than a gray cloud in July indicates snow.

Modifying Conditions to Evaluate in Studying Inflation

Increasing prices, advancing wages and increasing loans by banks are all indications of an inflation. But these must be studied in the light of modifying conditions. At the present time we have all of these things, but increasing prices are due to the shortage and high price of coal as a result of the strike and to higher wages. Higher wages are largely attributable to more emigration and less immigration. The increase in bank loans is due to a resumption of business activity and the fact that banks are beginning to look for commercial loans. During the past year over one and a half billion dollars worth of securities have been acquired by banks. Quite an appreciable part of these securities has been due to the floating of bond issues by corporations which came out of the boom and depression cycle with heavy bank indebtedness. Although the banks have largely absorbed these securities, they are now ready to market them to customers, and this they could not do with loans. So we have a condition wherein Barkis is willing (meaning the banks) to make commercial loans and they are able to do so to a greater extent than ever before, since the reserve requirements under the federal reserve act are less and the confidence in the reserve system is established.

But don't forget that Barkis himself had pretty hard sledding and he isn't going to dash into commercial loans with the old 1920 abandon—not for some years, even if it is tempting and a customer or two may be lost by more liberal credit grants by competitive banks.

Inflation Signals—How to Recognize Them

Where inflation begins is an uncertain point. There will undoubtedly be an inflation-deflation cycle in many industries before a period of general inflation lures us again to believe that "permanent" prosperity is ours. It therefore behooves us to learn the inflation symptoms in individual industries as well as in the country in general. Such symptoms are not easily discernible and not always reliable. One danger signal is when material sold exceeds normal consumption without apparent reason. That often means larger stocks laid in, anticipating larger demand, but if the normal consumption is exceeded, inevitably there will follow a reaction. A rise in price eliminating, if possible, speculative causes may be another danger signal. Wage increases within an industry and large increases in productive capacity are other signposts. But none of them are certain.

A Word of Caution

A word of caution to the technical man is not out of order. Everyone knows how much easier it is to operate with large stocks of raw materials available and with a stockroom crammed with every conceivable item which might be needed. Therefore the pressure of the operating man is always to increase stocks of all kinds. They should remember that there is another side to the question and that perhaps there is valid reason for scaling down orders — a thing which invariably arouses ire in the plant. The reason is a desire to avoid inflation.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	157.01
Last week	157.77
November, 1921	146.82
November, 1920	240
April, 1918 (high)	286
April, 1921 (low)	140

An error in the weighted index number for last week necessitate the publishing of the correct index number and for sake of clearness we are also publishing the figures for the two weeks previous.

October 18, 1922	153.77
October 25, 1922	157.71
November 1, 1922	157.77

Department of Commerce Items

Two rather striking items received attention in the recent *Commerce Reports*. One was newsprint paper and the other was steel.

Export Steel Trade Declines

The absence of expected purchases by Japanese interests has caused a loss in the August export figure for iron and steel. The monthly export figure showed steady improvement through the winter and reached a maximum in May. June showed a slight decline, but was still slightly in excess of 200,000 tons. The July and August figures represent only about 75 per cent of this figure, however, and unless an improvement takes place the yearly total will hardly equal the estimated figure of 2,200,000 tons.

While we are on steel and iron the situation in Germany is interesting. The exports are still slightly ahead of imports, but only slightly, and the expectation is that the year will show an unfavorable balance. The following figures are of considerable interest indicating the nature of the exports and imports in the iron and steel industry in Germany. The figures are for the first 7 months of 1922 and are recorded in tons:

GERMAN EXPORTS AND IMPORTS OF IRON AND STEEL FOR THE FIRST 7 MONTHS OF 1922

	Exports	Imports
Pig iron, scrap and ferro-alloys	116,806	507,437
Ingots, blooms, slabs, billets and sheet bars	27,541	144,821
Rails and accessories	206,266	61,412
Bar iron, hoop and girders	290,856	351,217
Rolls	4,779	108
Plates and sheets	137,969	33,003
Tin plate, galvanized sheets (plain and corrugated) and other sheets	16,900	7,473
Cast-iron pipe	26,935	25,871
Tubes and fittings	81,607	5,730
Bridge and other structural work	33,759	1,061
Railway axles and wheels, tires and springs	33,015	70
Carriage and cart axles	1,950	126
Wire, rolled and drawn	89,160	27,923
Wire rope and cord, barbed wire, wire gauze and cloth	36,116	261
Wire and cut nails and tacks	35,003	114
Screws and rivets	17,374	3,679
Ships' anchors	138	1
Horseshoes, calks, horseshoe nails and nails n.e.s.	2,914	21
Chains	4,390	38
Cask buoys, tanks, containers	6,613	220
Wagon springs	876	266
Iron and malleable castings and forgings, including machine parts	24,047	7,990
Total	1,195,014	1,178,842

Newsprint Paper

A table is given herewith of the estimated annual producing capacity and consumption of newsprint.

Perhaps the most interesting single

ANNUAL PRODUCING CAPACITY AND CONSUMPTION OF NEWSPRINT

Countries	Producing Capacity, Short Tons	Consumption Short Tons
Germany	530,000	300,000
Great Britain	300,000	450,000
France	150,000	210,000
Sweden	185,000	30,000
Finland	150,000	10,000
Norway	110,000	10,000
Other European countries	200,000	110,000
Total (Europe)	1,625,000	1,120,000
United States	1,500,000	2,000,000
Canada	1,000,000	130,000
Japan	150,000	.....
All other countries	40,000	.....
Total (world)	4,315,000	.....

item is the size of the Canadian production figure—from 150,000 tons in 1909 to about 1,000,000 in 1922. This arises principally from the Canadian provincial pulpwood embargoes, which make Canadian Crownland pulpwood unavailable for American mills. It is estimated that over half of the capital invested in Canadian mills is of American origin.

Still another table is of interest. It shows exports from the principal newsprint countries in 1913, 1920 and 1921.

EXPORTS OF NEWSPRINT IN 1913, 1920, AND 1921, METRIC TONS

Countries	1913	1920	1921
Germany	69,000	45,000	109,000
Finland	70,000	90,000	94,000
Sweden	62,000	116,000	112,000
Norway	98,000	77,000	46,000
Canada	70,000	79,000	47,000
United States	46,000	42,000	15,000

It shows the signal advance of Germany and Finland as production centers. Finland, it is stated, is likely to be a significant factor because of low production costs and the complete absence of labor troubles. These two countries, together with the Scandinavian countries, are bound to be factors in the American market. An interesting indication of this is the formation of selling organizations for groups of mills in this country. This closer relation plus the fact that newsprint is on the free list makes foreign competition here a certainty.

Centralized Export Facilities for Flour

Successful culmination of a project whereby tidewater terminal facilities are provided for export shipments of flour, is noted in the Oct. 25 issue of the *Northwestern Miller*.

On Oct. 21 the huge pier which constituted the Oregon Ave. Army Base in Philadelphia was dedicated to the use of the millers of the United States. The ceremonies which marked the formal opening of the pier were attended by millers from central states and the Middle West, officials of the Millers' National Federation, Eastern seaboard members of the flour trade, and representatives of transportation, banking and other financial interests.

The pier is 1,500 ft. long by nearly 300 ft. wide, accommodating two 3-story fireproof warehouses approximately 1,480 ft. long by 100 ft. wide, with a total flour storage capacity of 750,000 to 1,000,000 bbl. Fire walls divide each warehouse into five sections and each of the ten sections is served by double trackage full length. Each warehouse loads direct to boats on the full length of 1,500 ft. The pier is leased by the United States Shipping Board to an operating company, the Tidewater Terminal Co., headed by Harvey C. Miller. These facilities will enable export shipments of flour to be handled more nearly on the same basis as export wheat. The storage and handling facilities will also be available for making reshipments to domestic points so that the terminal need not be idle during periods of slack export trade.

The New York Market

NEW YORK, Nov. 6, 1922.

The alkali export market has again shown signs of buying interest, and leading dealers have marked up quotations. Italy and Japan have been the largest purchasers, but the demand is fairly widespread over various foreign countries. This is the first time that caustic soda has braced up during the past 4 months and the fact that this product is in some quarters regarded as the barometer of the chemical list has led large factors to believe that the industry will continue on its upward trend. Another important feature uncovered during the week was the announcement of bichromate prices by some producers over 1923. Manufacturers of chloroform advanced prices 10c. per lb., due to "increased costs of production." Producers of chlorate of soda increased prices ¼c. per lb. at the works. Formaldehyde was again advanced by makers and the condition of the spot and nearby shipment market is exceedingly firm. White arsenic still continues in excellent demand and prices are firmly maintained. Permanganate of potash was materially higher on spot and importers stated that inquiries were more numerous than at any other time during the previous month. Barium chloride showed an easier tendency on spot. The market, in general, has continued to show complete signs of strength and steadiness. Declines were few and of only minor importance and sellers were quite satisfied with the volume of passing business.

GENERAL AND SPECIAL CHEMICALS

Arsenic—The demand was very active and the general tone remained firm. Sales of spot goods were reported at 10¾@11c. per lb., with shipments held at 10½c. Stocks in warehouses are very scarce.

Barium Chloride—There has been much stronger competition in this product and prices are somewhat easier. Material on spot was quoted around $95@$100 per ton.

Bichromate of Soda—Sales of spot goods were recorded at 7½@7¾c. per lb. Leading factors quoted shipments over next year at 7½@7¾c. per lb. There were several rumors that other producers were offering contracts as low as 7@7¼c. per lb. The demand was moderate during the interval.

Caustic Soda—The condition of the export market has shown considerable improvement and prices were advanced to $3.60 per 100 lb. Domestic prices remain at $3.75@$4 per 100 lb. ex-store.

Chlorate of Potash—Most dealers were somewhat higher at 7¾@8c. per lb. for the powdered. Domestic producers are quite firm in their views at 8½@9c. per lb., f.o.b. works.

Chlorate of Soda—Leading producers have advanced quotations to 6½c. per lb., f.o.b. works, and report a strong market at this level. Imported spot goods are bringing 6¾@7c. per lb. for round lots. Demand is quite active.

Chloroform—Producers of U.S.P. material have announced a new advance of 10c. per lb. Spot material is now quoted at 35c. per lb. The advance is due to the increased cost of manufacturing.

Formaldehyde—Spot and shipment material has again been advanced and leading factors are quoting 14c. per lb., f.o.b. works, carload lots. The tone of the market is exceptionally firm.

Permanganate of Potash—Prime U.S.P. spot goods were quoted higher and the best figure was 16½c. per lb. The range was from 16½@17c. per lb. Demand continues quite steady.

Prussiate of Soda—Several odd lot sales were reported at 22¾@23c. per lb. The tone of the market was somewhat irregular during the week. Imported goods for shipment held around 23c. per pound.

COAL-TAR PRODUCTS

The coal-tar products industry has shown a steady improvement and producers state that business has increased considerably during the entire month of October. The crude products have shown the most noteworthy gains and products in several instances were heavily sold ahead. Phenol, cresylic acid and benzene were the leaders of this group. Among the intermediates, beta naphthol prices were advanced and spot offerings were relatively light. Dimethylaniline was advanced owing to added costs of manufacture and a much improved demand. Ortho-amidophenol was also quoted higher under the same conditions. Salicylic acid showed material gains during the interval, with U.S.P. goods in very light supply on spot.

Aniline Oil—Dealers were asking 16½@17c. per lb. for spot material, although producers still quoted 16c. per lb., f.o.b. works. Offerings were somewhat lighter with improved demand.

Beta Naphthol—Spot goods are very scarce and as high as 26c. per lb. has been paid. The general range was around 25@26c. per lb. Recent heavy buying has diminished surplus stocks.

Dimethylaniline—There has been a moderate inquiry noted at 34@35c. per lb. The new advance is due to higher costs of production.

The St. Louis Market

ST. LOUIS, Oct. 31, 1922.

The market in this locality remains very active, with orders continuing to increase in volume. Furthermore, the market has maintained a very steady tone since our last report. Transportation facilities are still very poor and no relief is in sight for some time.

ALKALIS

The *caustic soda* market is, and has been for some time, very quiet. Apparently no large volume of business is being done, practically all purchases being confined to 5- and 10-drum lots. Prices are as of our last report, with no tendency to weaken. Perhaps the steadiness in value is due to the fact that rock bottom has been reached and lower prices could come only by way of sacrifice on the part of manufacturers. What has just been said for caustic can be repeated with emphasis for *soda ash* and *bicarbonate of soda*. Prices hang around the same level and business moves with the same momentum. *Sal soda*, while still maintaining its price of 2 weeks ago, is moving better recently. One jobber reports heavy sales of both package goods and barrels, apparently quite a volume of this item having changed hands recently.

GENERAL AND SPECIAL CHEMICALS

Heavy mineral acids continue to improve and there has been a steady hardening of prices. The *phenol* situation remains firm and inquiry continues to be very heavy. The *citric acid* situation remains unchanged, the demand being only routine and sales confined to small quantities. *Acid tartaric* is in better demand since our last report. The *white arsenic* market is exceedingly strong and supplies are becoming scarcer, the market ranging from 10½@12½c. f.o.b. New York in carload lots. Manufacturers of *chloroform* advanced their prices 10c. on Saturday of last week. A fairly good call is noted for *cream of tartar*. The demand for *copperas* is still very heavy; producers are unable to meet it owing to the curtailment of production. The demand for *epsom salts* is very light and supplies are readily obtainable, prices ranging from $2.50@$2.60 per 100 lb. *Glycerine* is still maintaining the same firmness of 2 weeks ago—18½c. in drums—and is moving in good volume. Apparently there is no letdown in sight and 20c. glycerine before the end of the year is to be expected. *Sulphur*, while still selling at the abnormally low price of 2 weeks ago, is moving in large volume through the natural channels. *Zinc dust* is now being quoted at from 10@10½c. f.o.b. New York in carload lots and a strong market is reported. There has been no change in quotations for *zinc sulphate* since our last report.

VEGETABLE OILS AND NAVAL STORES

Turpentine continues to advance and reached $1.72 this week. No one seems to know or even be willing to venture a guess as to where this item will stop. *Castor oil* has finally had a relapse and has started downward. A reduction of ½c. per pound was recently made by the manufacturers, but we do not expect any further decline, since the demand is very active. *Linseed oil* has not changed in price. A good volume of business is being done through the natural channels, and the market seems to be safely in the producers' hands.

PAINT MATERIALS

Nothing of note has happened in this market since our last report. Prices have not changed and business at this time is somewhat slow.

The Iron and Steel Market

PITTSBURGH, Nov. 3, 1922.

Steel mill operations are at approximately the same rate as a week ago, and indeed there has been little variation since late in September, production being about 70 per cent of capacity.

Car supplies for shipping mill products have improved a trifle farther. Current production is being shipped without much difficulty, and there is a gradual diminution of the piles of steel accumulated when car shortages were serious. There are still many embargoes, making proper distribution difficult, but embargoes are not as numerous or widespread as a few weeks ago.

The chief point about the transportation situation is the danger of movement being greatly slowed down by the appearance of inclement weather. Most of the roads, if not all, are in precarious position and cannot stand any weather handicaps.

FINISHED STEEL MARKETS QUIET

The finished steel markets are extremely quiet. They have been quiet for several weeks, indeed, and the present state is really one of decided dullness. The strongest lines are sheets and tubular goods. In sheets the independents are booking nearly as much as they are shipping, but their order books are gradually decreasing and some have considerably less than a month's production ahead. In tubular goods there is not a great deal of new buying, but there is pressure upon mills for better deliveries against old orders, particularly for butt weld black and galvanized merchant pipe, demand for which has been extremely heavy on account of the boom in garage and dwelling house construction.

Delivery premiums on bars, shapes, plates and sheets are still less important than a week ago, their almost complete disappearance reflecting the early deliveries many mills are now able to offer on new orders, by reason of their having had heavy shipments of late, with little booking of new business.

FINISHED STEEL PRICES

Regular prices on finished steel products are as follows: Bars, shapes and plates, 2c.; hoops, 2.90@3c.; wire, 2.45c.; nails, $2.70; tin plate, $4.75; merchant steel pipe, 66 per cent basing discount; black sheets, 3.35@3.50c.; galvanized sheets, 4.35@4.50c.

The American Sheet & Tin Plate Co. will probably name prices next week for sheets for first quarter and tin plate for first half of the new year. Recently prospects were plain that advances would be announced in most cases, but the prospect is now considerably less certain, because other products are now likely to decline rather than advance when they again move.

A few weeks ago it was difficult to buy sheet bars at $40. This week there are a half dozen or more sellers offering tonnages. Definite prices are not quoted, but it is considered certain that purchases could be made at not above $38. There is no regular inquiry. Predictions are that the sheet bar market for first quarter delivery, when developed eventually, will be at not above $35.

COAL AND COKE

Coal prices in the Pittsburgh and Connellsville markets are a shade firmer than a week ago, steam being quotable at $3.25@$3.50 rather than at $3@$3.50. Good Youghiogheny gas coal is stronger, at $4.50 for mine-run and $5@$5.50 for screened. At the insistence of Fuel Director Spens operators of the Pittsburgh district have agreed to limit their price on domestic 1¼-in. lump to $4.50 and assume that for metallurgical coal they may feel free to get all the market will give them. The reduction in domestic coal may have had something to do with the stiffening in other grades.

Connellsville coke is a shade firmer than a week ago. Odd lots on track awaiting shipping instructions and commonly known as "distress coke" continue to go at about $7.50, while a regular supply over a week or two may possibly command $8.50 rather than the $8 quotable a week ago. The market has an undertone of strength that cannot be attributed to increasing demand and is in face of increasing production. The condition probably arises from a number of consumers having decided, on the recent break from $12 to $8, that they would do better to close to the end of the year than await any further decline.

PIG IRON

Pig iron continues to present a stagnant market. Prices are in a general process of readjustment, which may require several months for completion. Meanwhile consumers, whose requirements appear smaller than formerly, are disposed to buy only for immediate requirements, and in the absence of large inquiry little competition occurs between sellers. Bessemer continues to sell in small lots at $33 valley, and foundry in small lots at $30 valley. Basic, which was at $30 for several weeks, has sold at $29 valley in a lot of about a thousand tons. There is no basic inquiry now and the chances are that the next inquiry will develop a lower price.

General Chemicals

Current Wholesale Prices in New York Market

		Carlots F.o.b. N. Y.	Less Carlots F.o.b. N. Y.
Acetic anhydride	lb.	..... –	$0.38 – $0.40
Acetone	lb.	$0.19 – $0.20	.20 – .22
Acid, acetic, 28 per cent	100 lb.	2.92½ – 3.00	3.05 – 3.20
Acetic, 56 per cent	100 lb.	5.85 – 5.90	5.95 – 6.25
Acetic, glacial, 99½ per cent, carboys	100 lb.	11.16 – 11.20	11.25 – 11.50
Boric, crystals	lb.	.11 – .11½	.11½ – .12
Boric, powder	lb.	.11 – .11½	.11½ – .12½
Citric	lb.	..... –	.51 – .52
Hydrochloric	100 lb.	1.10 – 1.20	1.25 – 1.70
Hydrofluoric, 52 per cent	lb.	.11 – .11½	.11½ – .12
Lactic, 44 per cent tech	lb.	.09½ – .10	.10½ – .12
Lactic, 22 per cent tech	lb.	.04½ – .04¾	.05 – .05½
Molybdic, c.p.	lb.	3.00 – 3.25	3.30 – 3.75
Muriatic, 20 deg. (see hydrochloric)		..... –	..... – .....
Nitric, 40 deg.	lb.	.05½ – .05¾	.06 – .06½
Nitric, 42 deg.	lb.	.06 – .06½	.06½ – .07
Oxalic, crystals	lb.	.15 – .15½	.15½ – .16
Phosphoric, 50 per cent solution	lb.	.07½ – .08	.08½ – .09
Picric	lb.	.20 – .22	.23 – .27
Pyrogallic, resublimed	lb.	..... –	1.65 – 1.75
Sulphuric, 60 deg., tank cars	ton	9.00 – 10.00	..... – .....
Sulphuric, 60 deg., drums	ton	12.00 – 14.00	..... – .....
Sulphuric, 66 deg., tank cars	ton	14.50 – 15.00	..... – .....
Sulphuric, 66 deg., drums	ton	19.00 – 20.00	20.50 – 21.00
Sulphuric, 66 deg., carboys	ton	..... –	..... – .....
Sulphuric, fuming, 20 per cent (oleum) tank cars	ton	19.00 – 20.00	..... – .....
Sulphuric, fuming, 20 per cent (oleum) drums	ton	22.00 – 22.50	23.00 – 24.00
Sulphuric, fuming, 20 per cent (oleum) carboys	ton	31.00 – 32.00	33.00 – 34.00
Tannic, U. S. P.	lb.	..... –	.60 – .75
Tannic (tech.)	lb.	.40 – .45	.46 – .50
Tartaric, imported crystals	lb.	..... –	.31 – .31½
Tartaric acid, imported, powdered	lb.	..... –	.31½ – .32
Tartaric acid, domestic	lb.	..... –	..... – .32
Tungstic, per lb. of WO	lb.	..... –	1.00 – .110c
Alcohol, ethyl (Cologne spirit)	gal.	..... –	4.75 – 4.95
Alcohol, methyl (see methanol)		..... –	..... – .....
Alcohol, denatured, 188 proof No. 1	gal.	..... –	.36 – .38
Alcohol, denatured, 188 proof No. 5	gal.	..... –	.36 – .38
Alum, ammonia, lump	lb.	.03½ – .03¾	.04 – .04½
Alum, potash, lump	lb.	.03½ – .03¾	.04 – .04½
Alum, chrome lump	lb.	.05 – .05¼	.05½ – .06
Aluminum sulphate, commercial	100 lb.	1.50 – 1.65	1.70 – 2.25
Aluminum sulphate, iron free	lb.	.02½ – .02¾	.03 – .03½
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.06½ – .07¼	.07½ – .08
Ammonia, anhydrous, cyl. (100-150 lb.)	lb.	.30 – .30½	.30½ – .31
Ammonium carbonate, powder	lb.	.08½ – .08¾	.09 – .09½
Ammonium nitrate	lb.	.06 – .06½	.06½ – .07½
Amylacetate tech.	gal.	..... –	2.35 – 2.50
Arsenic, white, powdered	lb.	.10 – .11	.11½ – .11½
Arsenic, red, powdered	lb.	.12½ – .12¾	.13 – .13½
Barium carbonate	ton	75.00 – 77.00	78.00 – 80.00
Barium chloride	ton	95.00 –100.00	102.00 –105.00
Barium dioxide (peroxide)	lb.	.20 – .21	.21½ – .22
Barium nitrate		.09 – .09½	.09½ – .10
Barium sulphate (precip.) (blanc fixe)	lb.	.04 – .04¼	.04½ – .04¾
Blanc fixe, dry	lb.	.04 – .04½	..... – .....
Blanc fixe, pulp	ton	45.00 – 55.00	..... – .....
Bleaching powder	100 lb.	2.00 – 2.10	2.15 – 3.25
Blue vitriol (see copper sulphate)		..... –	..... – .....
Borax	lb.	.05½ – .05¾	.06 – .06¾
Brimstone (see sulphur, roll)		..... –	..... – .....
Bromine	lb.	.27 – .38	.28½ – .35
Calcium acetate	100 lb.	3.00 – 3.15	3.20 – 3.50
Calcium carbide	lb.	.04½ – .04¾	.05 – .05¼
Calcium chloride, fused, lump	ton	22.00 – 23.00	23.50 – 27.00
Calcium chloride, granulated	lb.	.01½ – .01¾	.02 – .02¼
Calcium peroxide	lb.	..... –	1.40 – 1.50
Calcium phosphate, tribasic	lb.	..... –	.15 – .16
Camphor	lb.	..... –	.88 – .90
Carbon bisulphide	lb.	.07 – .07½	.07½ – .07¾
Carbon tetrachloride, drums	lb.	.10 – .10½	.10½ – .12
Carbonyl chloride, (phosgene)	lb.	..... –	.60 – .75
Caustic potash (see potassium hydroxide)		..... –	..... – .....
Caustic soda (see sodium hydroxide)		..... –	..... – .....
Chalk, precip.—domestic, light	lb.	.04½ – .04¾	..... – .....
Chalk, precip.—domestic, heavy	lb.	.03½ – .03¾	..... – .....
Chalk, precip.—imported, light	lb.	.04½ – .05	..... – .....
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.05 – .05½	.05½ – .06
Chloroform	lb.	..... –	.35 – .38
Cobalt oxide	lb.	..... –	2.00 – 2.10
Copperas	ton	21.00 – 22.00	23.00 – 30.00
Copper carbonate, green precipitate	lb.	.21 – .21½	.22 – .22½
Copper cyanide	lb.	..... –	.58 – .600
Copper sulphate, crystals	100 lb.	5.75 – 6.00	6.10 – 6.504
Cream of tartar	lb.	..... –	.25½ – .26
Epsom salt (see magnesium sulphate)		..... –	..... – .....
Ethyl acetate com. 85%	gal.	..... –	.72 – .75
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	..... –	.90 – .95
Formaldehyde, 40 per cent	lb.	.14 – .14½	.14½ – .14¾
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00	..... – .....
Fullers earth—imported powdered	net ton	30.00 – 32.00	..... – .....
Fuse oil, ref.	gal.	..... –	2.75 – 2.90
Fusel oil, crude	gal.	..... –	1.65 – 1.85
Glauber's salt (see sodium sulphate)		..... –	..... – .....
Glycerine, c.p. drums extra	lb.	..... –	.18½ – .18¾
Iodine, resublimed	lb.	..... –	4.40 – 4.50
Iron oxide, red	lb.	..... –	.12 – .18
Lead acetate, white crystals	lb.	..... –	.11½ – .12½
Lead arsenate, powd.	lb.	.13 – .13½	.13½ – .14½
Lead nitrate	lb.	..... –	.15 – .20
Litharge	lb.	.07½ – .08	.08½ – .09
Magnesium carbonate, technical	lb.	.06 – .06½	.06½ – .07½
Magnesium sulphate, U.S.P.	100 lb.	2.50 – 2.65	2.70 – 3.50
Magnesium sulphate, technical	100 lb.	..... –	1.00 – 1.80
Methanol, 95%	gal.	..... –	.90 – .92
Methanol, 97%	gal.	..... –	.92 – .94
Nickel salt, double	lb.	..... –	.11 – .11½
Nickel salt, single	lb.	..... –	$0.12 – $0.12½
Phogene (see carbonyl chloride)		..... –	..... – .....
Phosphorus, red	lb.	..... –	.40 – .45
Phosphorus, yellow	lb.	..... –	.30 – .35½
Potassium bichromate	lb.	$0.10 – .10½	.10½ – .11
Potassium bromide, granular	lb.	..... –	.17 – .23
Potassium carbonate, U. S. P.	lb.	.12 – .12½	.13 – .16
Potassium carbonate, 80–85%	lb.	.06 – .06½	.06½ – .06½
Potassium chlorate, powdered and crystals	lb.	.07½ – .08	.08½ – .09
Potassium cyanide	lb.	..... –	.55 – .57
Potassium hydroxide (caustic potash)	100 lb.	6.25 – 6.50	6.60 – 7.00
Potassium iodide	lb.	..... –	3.45 – 3.55
Potassium nitrate	lb.	.06½ – .06¾	.07 – .08
Potassium permanganate	lb.	.16½ – .16¾	.17 – .17¼
Potassium prussiate, red	lb.	..... –	.95 – 1.00
Potassium prussiate, yellow	lb.	.37½ – .38	.38½ – .38½
Rochelle salts (see sodium potas. tartrate)		..... –	..... – .....
Salammoniac, white, granular	lb.	.06½ – .06¾	.07 – .07½
Salammoniac, gray, granular	lb.	.08¼ – .08½	.08½ – .09
Salsoda	100 lb.	1.20 – 1.40	1.45 – 1.60
Salt cake (bulk)	ton	25.00 –27.00	..... – .....
Soda ash, light, 58 per cent flat, bags, contract	100 lb.	1.60 – 1.67	2.00 – 2.25
Soda ash, light, 58 per cent flat, bags, resale	100 lb.	1.75 – 1.80	1.85 – 2.35
Soda ash, dense, in bags, resale	100 lb.	1.85 – 1.90	1.95 – 2.40
Sodium acetate	lb.	.08 – .08½	.08½ – .09
Sodium bicarbonate	100 lb.	1.75 – 1.85	1.90 – 2.30
Sodium bichromate	lb.	.07½ – .07¾	.08 – .08½
Sodium bisulphate (nitre cake)	ton	4.50 – 4.60	4.65 – 5.50
Sodium bisulphite powdered, U.S.P.	lb.	.04¾ – .04½	.04¾ – .05½
Sodium chlorate	lb.	.06½ – .07	.07¼ – .07½
Sodium chloride	long ton	12.00 –13.00	..... – .....
Sodium cyanide	lb.	.19½ – .21	.21½ – .25
Sodium fluoride	lb.	.09½ – .10	.10½ – .10½
Sodium hydroxide (caustic soda) solid, 76 per cent flat, drums, contract	100 lb.	3.35 – 3.40	3.75 – 4.00
Sodium hydroxide (caustic soda) solid, 76% flat, drums, resale	100 lb.	3.60 – 3.65	3.70 – 4.00
Sodium hydroxide (caustic soda), ground and flake, contracts	100 lb.	3.80 – 3.90	4.25 – 4.40
Sodium hydroxide (caustic soda) ground and flake, resale	100 lb.	4.00 – 4.15	4.40 – 4.60
Sodium hyposulphite	lb.	.02½ – .02¾	.03 – .03½
Sodium nitrite	lb.	.09 – .09½	.09½ – .10
Sodium peroxide, powdered	lb.	.28 – .30	.31 – .35
Sodium phosphate, dibasic	lb.	.03½ – .04	.04½ – .04½
Sodium potassium tartrate (Rochelle salts)	lb.	..... –	.18 – .21
Sodium prussiate, yellow	lb.	.22½ – .23	.23½ – .23½
Sodium silicate, (40 deg. in drums)	100 lb.	.80 – 1.00	1.05 – 1.25
Sodium silicate, (60 deg. in drums)	100 lb.	2.25 – 2.40	2.45 – 2.75
Sodium sulphate, crystals (glaubers salt)	100 lbs.	.85 – .95	1.00 – 1.40
Sodium sulphide, fused, 60-62 per cent (conc.)	lb.	.04 – .04½	.04½ – .05
Sodium sulphite, crystals	lb.	.03½ – .03¾	.03½ – .04½
Strontium nitrate, powdered	lb.	.09½ – .10	.10½ – .12
Sulphur chloride, yellow	lb.	.04½ – .05	.05½ – .06
Sulphur, crude	ton	18.00 –20.00	..... – .....
Sulphur dioxide, liquid, cylinders extra	lb.	.08 – .08½	.09 – .10
Sulphur (sublimed), flour	100 lb.	..... –	2.25 – 3.10
Sulphur, roll (brimstone)	100 lb.	2.00 – 2.15	2.20 – 2.70
Talc—imported	ton	30.00 –40.00	..... – .....
Talc—domestic powdered	ton	18.00 –25.00	..... – .....
Tin bichloride	lb.	.10 – .10½	.10½ – .10½
Tin oxide	lb.	..... –	.39 – .40
Zinc carbonate	lb.	.14 – .14½	.14½ – .15½
Zinc chloride, gran.	lb.	.07 – .07½	.07½ – .08
Zinc cyanide	lb.	.42 – .44	.45 – .47
Zinc oxide, XX	lb.	.07½ – .08	.08½ – .08½
Zinc sulphate	100 lb.	2.75 – 3.00	3.05 – 3.30

Coal-Tar Products

NOTE—These prices are for original packages in large quantities f.o.b. N.Y.:

Alpha-naphthol, crude	lb.	$0.95 — $1.00
Alpha-naphthol, refined	lb.	1.10 — 1.15
Alpha-naphthylamine	lb.	.29 — .31
Aniline oil, drums extra	lb.	.16½ — .17
Aniline salts	lb.	.22 — .24
Anthracene, 80% in drums (100 lb.)	lb.	.75 — 1.00
Benzaldehyde U.S.P.	lb.	1.25 — 1.35
Benzene, pure, water-white, in drums (100 gal.)	gal.	.30 — .35
Benzene, 90%, in drums (100 gal.)	gal.	.28 — .32
Benzidine, base	lb.	.85 — .95
Benzidine sulphate	lb	.80 — .85
Benzoic acid, U.S.P.	lb.	.72 — .75
Benzoate of soda, U.S.P.	lb.	.57 — .65
Benzyl chloride, 95-97%, refined	lb.	.25 — .27
Benzyl chloride, tech.	lb.	.20 — .23
Beta-naphthol benzoate	lb.	3.75 — 4.00
Beta-naphthol, sublimed	lb.	.53 — .55
Beta-naphthol, tech	lb.	.25 — .26
Beta-naphthyla mine, sublimed	lb.	1.50 — 1.60
Carbazol	lb.	.75 — .90
Cresol, U. S. P., in drums (100 lb.)	lb.	.14 — .20
Ortho-cresol, in drums (100 lb.)	lb.	.18 — .22
Cresylic acid, 97–99%, straw color, in drums	gal.	.60 — .65
Cresylic acid, 95-97%, dark, in drums	gal.	.55 — .58
Dichlorbenzene	lb.	.06 — .09
Diethylaniline	lb.	.50 — .60
Dimethylaniline	lb.	.34 — .36
Dinitrobenzene	lb.	.20 — .22
Dinitroclorbenzene	lb.	.21 — .22
Dinitronaphthalene	lb.	.30 — .32
Dinitrophenol	lb.	.32 — .34
Dinitrotoluene	lb.	.22 — .24
Dip oil, 25%, car lots, in drums	gal.	.85 — .90
Diphenylamine	lb.	.54 — .56
H-acid	lb.	.72 — .75
Meta-phenylenediamine	lb.	.90 — 1.00
Monochlorbenzene	lb.	.08 — .10
Monoethylaniline	lb.	.95 — 1.10
Naphthalene crushed, in bbls.	lb.	.06 — .06½
Naphthalene, flake	lb.	.06½ — .07
Naphthalene, balls	lb.	.07½ — .08
Naphthionate of soda	lb.	.58 — .65
Naphthionic acid, crude	lb.	.65 — .70
Nitrobenzene	lb.	.10 — .12

Nitro-naphthalene	lb.	$0.30 —	$0.35
Nitro-toluene	lb.	.15 —	.10
N-W acid	lb.	1.20 —	1.30
Ortho-amidophenol	lb.	2.25 —	2.30
Ortho-dichlor-benzene	lb.	.17 —	.20
Ortho-nitro-phenol	lb.	.80 —	.85
Ortho-nitro-toluene	lb.	.12 —	.15
Ortho-toluidine	lb.	.12 —	.14
Para-amidophenol, base	lb.	1.20 —	1.25
Para-amidophenol, HCl	lb.	1.25 —	1.30
Para-dichlorbenzene	lb.	.17 —	.20
Paranitroaniline	lb.	.72 —	.80
Para-nitrotoldene	lb.	.55 —	.65
Para-phenylenediamine	lb.	1.55 —	1.60
Para-toluidine	lb.	.85 —	.90
Phthalic anhydride	lb.	.35 —	.38
Phenol, U. S. P., drums	lb.	.30 —	.32
Pyridine	gal.	1.60 —	1.75
Resorcinol, technical	lb.	1.50 —	1.55
Resorcinol, pure	lb.	2.00 —	2.10
R-salt	lb.	.55 —	.60
Salicylic acid, tech., in bbls.	lb.	.33 —	.35
Salicylic acid, U. S. P.	lb.	.38 —	.40
Solvent naphtha, water-white, in drums, 100 gal.	gal.	.27 —	.32
Solvent naphtha, crude, heavy, in drums, 100 gal.	gal.	.12 —	.14
Sulphanilic acid, crude	lb.	.24 —	.26
Tolidine	lb.	1.20 —	1.30
Toluidine, mixed	lb.	.30 —	.35
Toluene, in tank cars	gal.	.25 —	.28
Toluene, in drums	gal.	.30 —	.35
Xylidines, drums, 100 gal.	lb.	.40 —	.45
Xylene, pure, in drums	gal.	.40 —	.45
Xylene, pure, in tank cars	gal.	.45 —	....
Xylene, commercial, in drums, 100 gal	gal.	.33 —	.35
Xylene, commercial, in tank cars	gal.	.30 —	....

Waxes

Prices based on original packages in large quantities f.o.b. N.Y.

Bayberry Wax	lb.	$0.20 —	$0.21
Beeswax, refined, dark	lb.	.30 —	.32
Beeswax, refined, light	lb.	.34 —	.35
Beeswax, pure white	lb.	.36 —	.40
Candelilla, wax	lb.	.33 —	.34
Carnauba, No. 1	lb.	.39 —	.40
Carnauba No. 2, North Country	lb.	.24 —	.25
Carnauba, No. 3, North Country	lb.	.17 —	.18
Japan	lb.	.15 —	.16
Montan, crude	lb.	.03½ —	.04
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.04 —	.04½
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.02½ —	.02¾
Paraffine waxes, refined, 118-120 m.p.	lb.	.03¼ —	.03½
Paraffine waxes, refined, 125 m.p.	lb.	.03½ —	.03¾
Paraffine waxes, refined, 128-130 m.p.	lb.	.04 —	.04¼
Paraffine waxes, refined, 133-135 m.p.	lb.	.04¼ —	.04½
Paraffine waxes, refined, 135-137 m.p.	lb.	.05 —	.05½
Stearic acid, single pressed	lb.	.09 —	.09½
Stearic acid, double pressed	lb.	.09½ —	.09¾
Stearic acid, triple pressed	lb.	.10½ —	.10

Naval Stores

All prices are f.o.b. New York unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Rosin B-D, bbl.	280 lb.	$6.90 —	....
Rosin E-I	280 lb.	6.95 —	....
Rosin K-N	280 lb.	7.00 —	$7.10
Rosin W. G.-W. W.	280 lb.	7.75 —	8.25
Wood rosin, bbl.	280 lb.	6.25 —	....
Spirits of turpentine	gal.	1.64 —	1.64
Wood turpentine, steam dist.	gal.	1.35 —	....
Wood turpentine, dest. dist.	gal.	1.25 —	....
Pine tar pitch, bbl.	200 lb.	.... —	6.00
Tar, kiln burned, bbl. (500 lb.)	bbl.	.... —	12.50
Retort tar, bbl.	500 lb.	.... —	11.00
Rosin oil, first run	gal.	.43 —	....
Rosin oil, second run	gal.	.51 —	....
Rosin oil, third run	gal.	.53 —	....
Pine oil, steam dist., sp.gr., 0.930-0.940	gal.		.90
Pine oil, pure, dest. dist.	gal.		.85
Pine tar oil, ref., sp.gr. 1.025-1.035	gal.		.46
Pine tar oil, crude, sp.gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fl.	gal.		.35
Pine tar oil, double ref., sp.gr. 0.965-0.990	gal.		.75
Pine tar, ref., thin, sp.gr., 1.080-1.960	gal.		.25
Hardwood oil, f.o.b. Mich., sp.gr., 0.960-0.990	gal.		.25
Pine wood creosote, ref.	gal.		.52

Fertilizers

Ammonium sulphate, f.a.s., N. Y., double bags	100 lb.	3.55 —	3.65
Blood, dried, f.o.b., N. Y.	unit	4.60 —	....
Bone, 3 and 50, ground, raw	ton	42.00 —	44.00
Fish scrap, dom., dried, f.o.b. works	unit	3.10 —	3.20
Nitrate of soda	100 lb.	2.35 —	2.45
Tankage, high grade, f.o.b. Chicago	unit	4.50 —	4.60
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	3.50 —	4.00
Tennessee, 78-80%	ton	7.00 —	8.00
Potassium muriate, 80%	ton	33.00 —	34.00
Potassium sulphate	unit	1.00 —	....

Crude Rubber

Para—Upriver fine	lb.	$0.24 —	.24½
Upriver coarse	lb.	.18½ —	.19
Upriver caucho ball	lb.	.18 —	.18¼
Plantation—First latex crepe	lb.	.22½ —	.22½
Ribbed smoked sheets	lb.	.22¼ —	.22½
Brown crepe, thin, clean	lb.	.20 —	.20½
Amber crepe No. 1	lb.	.20 —	.20½

Oils

VEGETABLE

The following prices are f.o.b. New York for carload lots.

Castor oil, No. 3, in bbls.	lb.	$0.12 —	$0.12½
Castor oil, AA, in bbls.	lb.	.12½ —	.13
China wood oil, in bbls.	lb.	.12½ —	.13
Cocoanut oil, Ceylon grade, in bbls.	lb.	.08½ —	.08¾
Cocoanut oil, Cochin grade, in bbls.	lb.	.08¾ —	.09
Corn oil, crude, in bbls.	lb.	.09½ —	.09¾
Cottonseed oil, crude (f. o. b. mill)	lb.	.07½ —	....
Cottonseed oil, summer yellow	lb.	.10½ —	.10¾
Cottonseed oil, winter yellow	lb.	.11¼ —	.11½
Linseed oil, raw, car lots (domestic)	gal.	.89 —	.90
Linseed oil, raw, tank cars (domestic)	gal.	.86 —	.87
Linseed oil, boiled, in 5-bbl lots (domestic)	gal.	.90 —	.92
Olive oil, denatured	gal.	1.15 —	1.17
Palm, Lagos	lb.	.07 —	.07½
Palm, Niger	lb.	.06½ —	.06¾
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.08¼ —	.09
Peanut oil, refined, in bbls.	lb.	.12½ —	.13
Rapeseed oil, refined in bbls.	gal.	.77 —	.78
Rapeseed oil, blown, in bbls.	gal.	.84 —	.85
Soya bean oil (Manchurian), in bbls. N. Y.	lb.	.11½ —	....
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.08¾ —	.09

FISH

Light pressed menhaden	gal.	$0.54 —	....
White bleached menhaden	gal.	.58 —	.59
Blown menhaden	gal.	.64 —	.65
Whale Oil, No. 1. crude, tanks, coast	gal.	.45 —	.48

Ferro-Alloys

Ferrotitanium, 15-18%, f.o.b. Niagara Falls, N. Y.	net ton	$200.00 —	$225.00
Ferrochromium, per lb. of Cr contained, 6-8% carbon, carlots	lb.	.11 —	.12
Ferrochromium, per lb. of Cr contained, 4-6% carbon, carlots	lb.	.12 —	.13
Ferromanganese, 78-82% Mn, Atlantic seaboard	gross ton	67.50 —	69.00
Spiegeleisen, 19-21% Mn	gross ton	37.00 —	38.00
Ferromolybdenum, 50-60% Mo, per lb. of Mo	lb.	2.00 —	2.25
Ferrosilicon, 10-15%	gross ton	38.00 —	40.00
Ferrosilicon, 50%	gross ton	68.00 —	70.00
Ferrosilicon 75%	gross ton	115.00 —	120.00
Ferrotungsten, 70-80%, per lb. of contained W	lb.	.90 —	.95
Ferro-uranium, 35-50% of U, per lb. of U content	lb.	6.00 —	....
Ferrovanadium, 30-40% per lb. of contained V.	lb.	3.50 —	4.00

Ores and Semi-finished Products

All f.o.b. New York Unless Otherwise Stated

Bauxite, domestic, crushed and dried, f.o.b. shipping points	net ton	$6.00 —	$9.00
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 —	23.00
Chrome ore, 50% Cr_2O_3, f.o.b. Atlantic seaboard	ton	19.00 —	20.00
Coke, foundry, f.o.b. ovens	net ton	10.00 —	10.50
Coke, furnace, f.o.b. ovens	net ton	7.50 —	8.00
Fluorspar, gravel, f.o.b. mines, New Mexico	net ton	15.00 —	....
Fluorspar, standard, domestic washed gravel Kentucky and Illinois mines	net ton	17.50 —	19.00
Ilmenite, 52% TiO_2, per lb. ore	lb.	.01½ —	.01¾
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.45 —	....
Manganese ore, chemical (MnO_2)	net ton	70.00 —	75.00
Molybdenite, 85% MoS_2, per lb. of MoS_2, N. Y.	lb.	.80 —	.85
Monazite, per unit of ThO_2, c.i.f., Atlantic seaport	unit	27.00 —	....
Pyrites, Spanish, fines, c.i.f., Atlantic seaport	unit	.10½ —	.11
Pyrites, Spanish, furnace size, c.i.f. Atlantic seaport	unit	.12 —	.13½
Pyrites, domestic, fines, f.o.b. mines, Ga.	unit	Nominal	
Rutile, 95% TiO_2 per lb. ore	lb.	.12 —	....
Tungsten, scheelite, 60% WO_3 and over, per unit of WO_3 (nominal)	unit	8.00 —	8.25
Tungsten, wolframite, 60% WO_3 and over, per unit of WO_3, N. Y. C.	unit	7.75 —	8.00
Uranium ore (carnotite) per lb. of U_3O_8	lb.	1.25 —	1.75
Uranium oxide, 96% per lb. contained U_3O_8	lb.	2.25 —	2.50
Vanadium pentoxide, 99%	lb.	12.00 —	14.00
Vanadium ore, per lb. of V_2O_5 contained	lb.	1.00 —	....
Zircon, washed, iron free, f.o.b. Pablo, Florida	lb.	.04½ —	.13½

Non-Ferrous Metals

All f.o.b. New York Unless Otherwise Stated

	Cents per Lb.
Copper, electrolytic	13.75–13.875
Aluminum, 98 to 99 per cent.	20.00-21.00
Antimony, wholesale lots, Chinese and Japanese	6.75–7.00
Nickel, ordinary (ingot)	36.00
Nickel, electrolytic	39.00
Nickel, electrolytic, resale	32.00–33.00
Nickel, ingot and shot, resale	30.00–31.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	35.00
Monel metal, sheet bars	38.00
Tin, 5-ton lots, Straits	36.25
Lead, New York, spot	6.75–6.80
Lead, E. St. Louis, spot	6.50
Zinc, spot, New York	7.45–7.50
Zinc, spot, E. St. Louis	7.10–7.15

OTHER METALS

Silver (commercial)	oz.	$0.67
Cadmium	lb.	1.15
Bismuth (500 lb. lots)	lb.	2.45
Cobalt	lb.	3.00@3.25
Magnesium, ingots, 99 per cent.	lb.	1.00@1.05
Platinum	oz.	$108.00
Iridium	oz.	240.00@275.00
Palladium	oz.	52.00@55.00
Mercury	75 lb.	72.00

Industrial

Financial, Construction and Manufacturers' News

Industrial Developments

OILS—Martin & Co., Transportation Bldg., Chicago, Ill., have inaugurated operations at their new oil refinery at Osborne, Ind. Portions of the plant are still to be completed and equipment will be installed at an early date. The refinery will run on crude oil from the Pioneer field, Tex.

The Premier Refining Co., Oatsville, near Princeton, Ind., has placed its new gasoline-refining plant in operation and will develop maximum output at an early date. This is the first such refinery in Gibson County.

The Globe Petroleum Co., Los Angeles, Calif., is increasing production at its different plants, and exclusive of royalty plant leases, an average of 150,000 bbl. of oil per month will be maintained.

About 50 per cent of the independent oil refineries in Oklahoma are closed down or have curtailed operations, due to the general conditions in the mid-continent fields, according to an official statement made at the meeting of the Oklahoma Oil Jobbers' Association, Oklahoma City, Oct. 19.

The New England Refining Co. has advanced production at its Fall River, Mass., plant to a basis of 20,000 to 25,000 bbl. of crude oil through the stills per day.

RUBBER—The Studebaker-Wulff Rubber Co. has adopted a day and night basis of operation at its local plant, giving employment to a full working force. Extensions are planned to double the present capacity.

Negotiations are said to be in progress for the sale of the plant of the Philadelphia Rubber Works, 37th and Reed Sts., Philadelphia, Pa., to new interests, which propose to place the plant in operation at an early date. It has been closed since 1919.

PAPER—The Philadelphia Paper Mfg. Co., Philadelphia, Pa., has developed capacity operations and is now running on the basis of 500 tons per day. A wage advance of 15 per cent was recently made at the mill. About one-fourth of the output is being utilized at the plant of the Fiber Container Co., a subsidiary organization, which is also running full.

The Kieckhefer Container Co., Camden, N. J., is operating at full capacity at its paper and fiber plants, giving employment to regular working force. A new plant is being built at Delair, near Camden, and will be placed in service as soon as completed.

Every newsprint paper mill in Canada, totaling thirteen in all, is running on a full-capacity, full-time basis, with maximum output the highest in a number of years. For the first 7 months of the present year the production totaled 643,858 tons, or more than the total for any year prior to 1917. The Spanish River Paper Co., Ottawa, one of the largest producers, is running full in all departments of its mills.

IRON AND STEEL—The Bourne-Fuller Co., Cleveland, O., has blown in another furnace at its plant.

The American Bridge Co. has placed all furnaces in blast at its Pencoyd Works, Manayunk, Philadelphia, Pa., and will maintain on this basis for an indefinite period.

The Crane Iron Works, Catasauqua, Pa., is making improvements and repairs in its large blast furnace, and expects to have the unit ready for blast some time in December. The date of blowing in will be announced soon.

The American Steel & Wire Co., Cleveland, O., has blown in another furnace at its local mills.

The Eastern Steel Co., Pottsville, Pa., has placed its local plant on a full-production basis, and is said to have orders on hand to keep the six mills at this point for about 12 months to come. The Pottstown, Pa., furnaces of the company are also all on the active list.

The Carnegie Steel Co. has placed its Farrell, Pa., works on a full-capacity schedule, and will maintain on this basis for an indefinite period.

The American Sheet & Tin Plate Co. has started up all of the forty hot mills at its Shenango Works, near New Castle, Pa.; ten of the mills have been idle for about 6 months past.

The Republic Iron & Steel Co., East Chicago, Ind., has closed its local mills for an indefinite period, due, primarily, to the decreased demand for bar iron. About 400 men will be released until further notice.

The Robesonia Iron Co., Reading, Pa., is arranging to blow in its large stack about Nov. 15. The plant has been idle for repairs to the furnace for a number of weeks past.

The American Sheet & Tin Plate Co. has placed the twelve hot mills in operation at its New Philadelphia, Pa., plans, after a short curtailment. About 350 men will be employed. The company has recently booked heavy orders in sheet bars.

Steel plants in all parts of the country are now running on a basis of about 75 to 80 per cent of normal. Increased working forces are being employed.

MISCELLANEOUS—The Barrett Co., Grays Ferry district, Philadelphia, Pa., manufacturer of coal-tar products, has adopted a capacity operating schedule at its plant, and will continue on this basis for an indefinite period. A full working force is employed.

The National Sulphur Co., Bayonne, N. J., has commenced operations at its new plant at North Akron, O., on a full-time production basis. The initial output is expected to be advanced at an early date. The company will remove its New York office to North Akron.

Brick-manufacturing plants in the vicinity of Atlanta, Ga., are making ready for a full-time production schedule immediately, following a shut-down due to the railroad car shortage. It is said that every plant in this district has orders ahead to insure capacity for a number of months to come.

The Henry Bower Chemical Mfg. Co., Manayunk, Philadelphia, Pa., is running on a full-capacity, full-time basis, with employment of normal working force. Less than 6 months ago the plant was practically closed down due to lack of orders. The orders on hand insure maximum operations for some time to come.

The Diamond State Fiber Co. has closed down its plant at West Conshohocken, Pa., temporarily, due to the demand of employees for a wage advance of 10 cents per hour, and the company's refusal to meet the request. More than 200 workers are affected by the shut-down.

The R. M. Hollingshead Co., Camden, N. J., manufacturer of soaps, leather dressings, etc., is increasing production at its plant and is now running at close to capacity.

The Chattanooga Coke & Gas Co., Chattanooga, Tenn., has resumed operations at its coke works, following a suspension for a number of weeks. Byproduct gas is also being furnished again to local consumers.

Construction and Operation

Alabama

TARRANT CITY—The Lehigh Portland Cement Co., Allentown, Pa., has awarded a contract to Dwight P. Robinson & Co., Inc., 125 East 46th St., New York, N. Y., for the erection of its proposed cement-manufacturing plant at Tarrant City, near Birmingham. It will be equipped for an annual production of 1,000,000 bbl., and is estimated to cost close to $1,500,000 with machinery. It is purposed to have the mill ready for operation in about 12 months.

California

ANAHEIM—Charles A. Criss is completing plans for the construction of a new plant at 315 South Vine St., for the manufacture of cement brick and art cement products. It will consist of three buildings.

LOS ANGELES—The W. P. Fuller Paint Co., Los Angeles, has awarded a contract to Lepper & Laisy, O. T. Johnson Bldg., for the erection of its proposed 2-story plant on Ave. 22, 120x125 ft., estimated to cost approximately $45,000.

FRESNO—The United Engine & Machine Co. recently organized with capital of $250,000, to merge the Sulprizio Machine Works, 507 Broadway, and the Fresno Pattern Works, 2137 Cherry St., has plans in progress for the erection of a 1-story foundry and molding shop, 100x150 ft., for iron and steel castings production. G. J. Dolan, Jr., is head.

LONG BEACH — The American Avenue Glas Co. has acquired a site on West 15th St., Inner Harbor district, 80x125 ft., for the erection of a new glass-manufacturing plant. Theodore J. Stein is president.

Connecticut

WEST HAVEN—The Sanderson Fertilizer Co. has filed plans for the erection of a new 1-story building at its plant.

BERLIN—The Stiles & Reynolds Co. plans for the rebuilding of the portion of its brick-manufacturing plant on Christian Lane, destroyed by fire, Oct. 23, with loss estimated at about $18,000.

HARTFORD—The Skat Co., Francis Ave., manufacturer of soap, soap powders, etc., has filed plans for the erection of a 2-story addition, 40x75 ft.

Florida

FORT LAUDERDALE — The International Sugar Co. has tentative plans under consideration for the construction of a new sugar refinery and mill on site near Fort Lauderdale. The proposed plant will have an initial capacity of about 1,500 tons per day, and is estimated to cost in excess of $500,000, with machinery. It is expected to commence work during the coming year. Howard L. Allen is general manager.

WEST PALM BEACH—Carl Riddel, city manager, is developing plans for the purchase of the artificial gas works now furnishing service to the city. When the plant is taken over, extensions and improvements will be made.

Illinois

GRANITE CITY—The Mepham Paint Co., East St. Louis, Ill., has plans in progress for the erection of a new plant on local site, 1-story, 100x100 ft., estimated to cost close to $100,000. It will be used primarily for copperas production.

CHICAGO — The Patterson-Sargent Co., 2025 Lumber St., manufacturer of paints and varnishes, has excavations under way for the erection of a new 4-story building at Lumber and Stewart Sts., 60x125 ft., and expects to have the structure ready for occupancy early in the coming spring. Additional land has been obtained, 75x200 ft., for proposed later extensions.

Indiana

EVANSVILLE—The Evansville Enameling Co., Fulton St., will take bids at once for the erection of its proposed 1-story addition, 50x85 ft., estimated to cost about $55,000, including equipment. Russ & Karges, Furniture Bldg., are architects.

EVANSVILLE — The Globe-Bosse-World Furniture Co. has had plans prepared for the construction of a 1-story plant addition, 45x160 ft., to be equipped for the manufacture of mirrors. Russ & Karges, Furniture Bldg., are architects.

Kansas

AUGUSTA—The White Eagle Oil & Refining Co., Wichita, Kan., has construction nearing completion on a new unit at its local refinery, to increase the capacity of the cracking stills. The extension will be placed in service at an early date.

Kentucky

ASHLAND—The American Rolling Mill Co., Middletown, O., has plans in progress for the erection of an addition to its local plant, to include a new sheet mill, jibbing mill and galvanizing works. Dwight P. Robinson & Co., Inc., 125 East 46th St., New York, N. Y., is engineer.

Louisiana

MONROE—The Louisiana Producing & Carbon Co. has plans under way for the construction of a new carbon and gasoline extraction plant, estimated to cost in excess of $150,000. The carbon works will comprise two individual plant units, the first of which will be ready for service early in 1923, and at which time erection of the second unit will be commenced. The complete plant will have a capacity of 8,000 lb. of carbon black per day. The gasoline plant will be of vertical absorption type, with treating capacity of 10,000,000 cu.ft. of gas per 24 hr. The company has recently increased its capital to $350,000 for the expansion. R. R. Beaman is president.

Maryland

CAMBRIDGE—Fire, Oct. 27, destroyed a portion of the plant of the Dorchester Fertilizer & Lime Co., Trenton St. and Cambridge Creek, with loss estimated at about $65,000. It is planned to rebuild at a later date. Lloyd Webster and John Skinner head the company.

BROOKLYN—The Arundel-Shope Brick Co., Pier 2, Pratt St., Baltimore, is perfecting plans for the erection of its proposed new brick-manufacturing plant on local site, to consist of a number of buildings with power house. Lawson L. Wagner is president and manager.

BALTIMORE—The Holtite Mfg. Co., Warner and Ostend Sts., manufacturer of rubber specialties, has plans in preparation for the erection of a new 1-story plant addition, 50x155 ft., to double, approximately, the present output. Stanislaus Russell, 11 East Lexington St., is architect.

BALTIMORE—Fire, Oct. 23, destroyed a large portion of the plant of the Porcelain Enamel & Mfg. Co., O'Donnell and 8th Sts., with loss estimated at about $400,000, including buildings and equipment. It is planned to rebuild. Heinrich Turk is president.

EASTON—The City Council is arranging plans for the purchase of the local artificial gas plant, and will operate as municipal property. It is proposed to issue bonds for extensions and improvements.

BALTIMORE—The Standard Oil Co. has filed plans for the erection of a 1-story asphalt works, 124x204 ft., at 2nd Ave. and 2nd St., estimated to cost about $40,000.

Massachusetts

BOSTON—The Tileston & Hollingsworth Co., River St., Hyde Park, has awarded a contract to the Aberthaw Construction Co., 27 School St., Boston, for the erection of a 1-story addition to its paper manufacturing plant, to cost about $30,000. George F. Hardy, 309 Broadway, New York, N. Y., is engineer.

SOMERSET—Fire, Oct. 24, destroyed a portion of the plant of the E. S. Parks Shellac Co., including drying department. An official estimate of loss has not been made.

Michigan

BAY CITY—Construction is being rushed on the new local plant of the Wildman Rubber Co., and is expected to have the structure ready for the machinery installation at an early date. It will be 4-story, 165x365 ft., and will be used primarily for automobile tire production.

Minnesota

MINNEAPOLIS—The Carter-Mayhew Mfg. Co., is planning for the construction of a new 1-story foundry at its mechanical works, 19th Ave., N.E., 60x100 ft., estimated to cost close to $30,000.

Missouri

SARCOXIE—The plant of the Sarcoxie Lime Kiln Co. has been acquired by H. T. Oltman and Charles Shull. The new owners will continue the operation of the property for the manufacture of commercial fertilizer products, and plan for extensions and improvements, including the installation of a new crushing plant.

New Jersey

SALEM—Fire, Oct. 27, destroyed a building at the plant of the Gayner Glass Works, with loss estimated at about $100,000, including stock, equipment, etc. The company specializes in the manufacture of bottles, jars, etc.

New York

BINGHAMTON—The American Hide & Leather Co. has disposed of its local tannery to the Endicott-Johnson Corp., manufacturer of footwear, which will continue the operation of the plant.

RICHMOND HILL, L. I.—The Unique Leather Goods Co., Jamaica Ave., has awarded a contract to the Ettinger Contracting Co., 44 Court St., Brooklyn, for the erection of a 2-story addition, 80x400 ft. William Higginson, 15 Park Row, New York, is architect.

BUFFALO—The Bethlehem Steel Co. is arranging an extension and improvement program for its local Lackawanna Steel works, estimated to cost in excess of $10,000,000, including buildings, machinery, etc. The initial work will comprise the modernizing of a number of plant departments.

North Carolina

HERTFORD—Fire, Oct. 22, destroyed a portion of the plant of the Eastern Cotton Oil Co., with loss estimated at about $35,000. It is planned to rebuild.

LEXINGTON—The Rodrain Electro-Metallurgical Co., Salisbury, N. C., has tentative plans under way for the construction of a new 3-story plant for gold refining at its Gold Hill mine, estimated to cost approximately $500,000. J. L. Mittenhuler heads the company.

Ohio

ELYRIA—Negotiations are under way for the purchase and reorganization of the Columbia Steel Co. A new company will be formed under the present name with capital of $1,500,000, and extensions and improvements made in the present plant, including the installation of improved processes of production in a number of departments. It is purposed to issue bonds for $750,000, a portion of the fund to be used for the expansion. C. E. Lozier, vice-president and general manager of the present organization, will head the new company.

Oklahoma

PONCA CITY—The Empire Refineries, Inc., will make additional extensions and improvements in its oil refining plant to cost close to $1,000,000. Work on an initial program calling for an investment of about $2,000,000 is now nearing completion, and new plant units will be placed in service at an early date. The refinery is now running on a basis of 4,000 bbl. per day.

MUSKOGEE—The Oklahoma Fabric & Rubber Co., recently organized with a capital of $2,500,000 by officials of the Allen Tire & Rubber Co., Allentown, Pa., has acquired a local building and site for the establishment of its proposed plant for the manufacture of tires and other rubber products. Extensions and improvements will be made in the present structure to cost in excess of $1,000,000, including machinery installation. The local Chamber of Commerce is interested in the project.

Oregon

GRANTS PASS—The Beaver Portland Cement Co., Portland, is reported to be planning for the construction of a new cement mill in the vicinity of Grants Pass, estimated to cost in excess of $750,000. The entire project will include the development of raw material properties in Josephine County and the construction of a private railroad line, to involve a total expenditure of about $1,200,000.

Pennsylvania

MCKEES ROCKS—The Federal Enameling & Stamping Co., Thompson Ave., is completing plans for the erection of a new 3-story plant addition. A portion of the structure will be equipped as a furnace department. C. E. Christian is in charge.

PITTSBURGH—The Pruett-Schaffer Chemical Co., Tabor St., manufacturer of paint, etc., has acquired a tract of vacant property at Lincoln Ave. and Ohio St., for $15,000, for future expansion.

Tennessee

COLUMBIA—The plant and property of the Ruhm Phosphate Co. have been purchased by J. P. Greenlaw and associates. The new owners plan for extensions and improvements in the grinding plant and other departments.

MEMPHIS—Fire, Oct. 22, destroyed a building at the plant of the Plough Chemical Co., with loss reported at about $125,000. It is expected to rebuild.

Texas

GONZALES—The Gonzales Cement Works, Inc., has plans under way for the erection of a new plant, 50x90 ft., with adjoining structure, 40x50 ft., for the manufacture of cement tile and kindred products. A. O. Neumann heads the company

JACKSONVILLE—The Jacksonville Cotton Oil Co. is reported to be planning for the rebuilding of its plant, totally destroyed by fire, Oct. 16. An official estimate of loss has not been announced.

TEXAS CITY—The Terminal Oil & Refining Co. is planning for extensions in its topping plant to more than double the present capacity. Work will be commenced at an early date. C. E. Robertson is superintendent.

Utah

SALT LAKE CITY—The Salt Lake Insecticide Co. is pushing construction on its new local plant for the treatment of ores from the properties of the Western Utah Copper Co. The plant is designed to recover the arsenic in the form of calcoum arsenate, utilizing lead or zinc oxide in the process. Dr. Frank W. Cameron is general manager.

Washington

VANCOUVER—The United States Molybdenum Metals, Ltd., operating in the St. Helens mining district, near Spirit Lake, has acquired the former shipyard property of the Standifer Shipbuilding Co., as a site for the erection of a new smelting and refining plant. Work will be commenced at an early date. Headquarters of the company are at 16 Natoma St., San Francisco, Calif.

SEATTLE—The Washington Iron Works will commence the immediate erection of a new 1-story foundry, 130x660 ft., for the production of iron and steel castings, estimated to cost about $90,000. Richard Ellis is company engineer.

West Virginia

WHEELING—Plans are being prepared for the construction of a new filtration plant at the municipal waterworks, and bids for equipment are expected to be asked early in December. The plant will have a capacity of 20,000,000 gal. With new power house, tanks and pumping station, the project will cost about $1,000,000. J. N. Chester, Union Bldg., Pittsburgh, Pa., is engineer.

Canada

MONTREAL—The Howard Smith Paper Mills, Ltd., has authorized plans for the construction of a new plant for the production of bleached soda pulp, to have an initial capacity of about 15,000 tons per annum.

New Companies

THE RENSSELAER PAPER CO., New York, N. Y., care of J. L. Holtzman, Woolworth Bldg., representative, has been incorporated with a capital of $50,000, to manufacture paper products. The incorporators are S. Berkman, A. Krissoff and M. Carberry.

THE AMERICAN VAT COLOR MFG. CO., 3223 Western Blvd., Chicago, Ill., has been incorporated with a capital of 4,500 shares of stock, no par value, to manufacture synthetic organic chemical products. Incorporators: William J. Loeffler, E. C. Kohlsaat and H. F. Clark.

THE CLINTON CHEMICAL CORP., Irvington, Newark, N. J., has been incorporated with a capital of $125,000, to manufacture chemical products, gasoline intensifiers, etc. The incorporators are Henry S. DeForest, Francis W. Wilcox and George F. Schmitt, 1045½ Clinton Ave., Irvington. The last noted represents the company.

THE CHEMICAL PRODUCTS CORP., Providence, R. I., has been incorporated with a capital of $10,000, to manufacture chemicals and chemical byproducts. The incorporators are James B. Littlefield, Fred A. Otis and Gilbreth Brown, 24 Audubon Ave., Providence. The last noted represents the company.

THE CRYSTAL SOAP & CHEMICAL CO., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws with capital of $100,000, to manufacture chemical products, soaps and kindred specialties.

THE MORRIS PETROLEUM CO., Somerset, Ky., has been incorporated with a capital of $25,000, to manufacture petroleum products. The incorporators are Jackson Morris and Leslie Combest, Somerset; and Henry J. Stites, Louisville, Ky.

THE CASS CHEMICAL CO., 4405 Cass Ave., Detroit, Mich., has been organized under state laws to manufacture chemical specialties, synthetic products, etc. The incorporators are Edward Hirschfeld and Benjamin Meyers.

THE YOUNGSTOWN HIDE & TALLOW CO., Youngstown, O., has been incorporated with a capital of $25,000, to manufacture tallow, greases, and kindred specialties. The incorporators are George J. Bickler and L. J. Ferbstein, both of Youngstown.

THE RED BALL REFINING CO., 1400 Consumers' Bldg., Chicago, Ill., has been incorporated with a capital of $100,000, to manufacture refined oils, etc. The incorporators are F. G. Howell, B. Groh and L. E. Walther.

THE DRURY MFG. CO., Mineola, L. I., care of T. C. Horton, Rahway, N. J., representative, has been incorporated with a capital of $15,000, to manufacture brick, tile and kindred burned clay products. The incorporators are W. F. Drury and R. C. Hunt.

THE SEMINOLE PRODUCTS CO., Jacksonville, Fla., has been incorporated with a capital of $400,000, to manufacture cement products. J. R. Nordquest is president; and Harry Mills, secretary, both of Jacksonville.

THE DEN-WAL MFG. CO., Newark, N. J., has been incorporated with a capital of $100,000, to manufacture chemicals and chemical byproducts. The incorporators are H. L. Davis, Nathan P. Walton and James A. Dennis, 8 Jefferson St., Newark. The last noted represents the company.

THE LOUISVILLE PETROLEUM REFINING CO., Louisville, Ky., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative, has been incorporated with a capital of $500,000, to manufacture refined petroleum products and byproducts.

THE SHO-FORM CO., Buffalo, N. Y., care of Persons & Blair, White Bldg., Buffalo, representatives, has been incorporated with a capital of $25,000, to manufacture soap products. The incorporators are W. F. and E. G. Messing, and L. E. Moschel, all of Buffalo.

THE STENSEL-SPEAR MICA CO., New York, N. Y., care of Oscar Lowenstein, 27 Cedar St., New York, representative, has been incorporated with a capital of $12,000, to manufacture mica products. The incorporators are H. S. Spear, E. and A. Stensel.

THE VAL-O CHEMICAL CO., 823 North Broadway, Decatur, Ill., has been incorporated with a capital of $50,000, to manufacture chemical specialties. The incorporators are Val H. Chronister, H. M. McMillan and N. Stookey.

THE ADANAC-TEXAS OIL CO., San Antonio, Tex., has been incorporated with a capital of $150,000, to manufacture petroleum products. The incorporators are B. W. Somers, C. L. Watson and J. D. Reese, all of San Antonio.

THE EASTERN REFINING CO., New York, N. Y., care of the United States Corporation Co., 65 Cedar St., New York, representative, has been incorporated under Delaware laws with capital of $50,000, to manufacture refined petroleum products.

THE TEXARKANA PAINT CO., Texarkana, Ark., has been incorporated with a capital of $25,000, to manufacture paint, varnish and kindred products. The incorporators are B. H. Kuhl, H. H. and J. H. Harrell, all of Texarkana.

THE ROYAL PAPER PRODUCTS CO., New York, N. Y., care of M. I. Murzin, 233 Broadway, representative, has been incorporated with a capital of $25,000, to manufacture paper specialties. The incorporators are I. Levy, D. and C. Rosenthal, all of New York.

THE MOHAWK OIL CO., San Francisco, Cal., has been incorporated with a capital of $3,000,000, to manufacture petroleum products. The incorporators are C. E. Ward, L. B. Cook, F. R. Stewart and Joseph C. Meyerstein, 57 Post St., San Francisco. The last noted represents the company.

THE NOUN CHEMICAL CO., New York, N. Y., care of J. F. Neuman, Jr., 601 West 144th St., New York, representative, has been incorporated with a capital of $5,000, to manufacture chemical specialties. The incorporators are E. D. Neuman and H. C. Harvey.

THE NATIONAL TILE WORKS, INC., New Brunswick, N. J., has been incorporated with a capital of $25,000, to manufacture ceramic tile products. The incorporators are Samuel and Joseph LiCausi, 146 Neilson St., New Brunswick. The last noted represents the company.

THE MCELMORE COVE OIL CO., Chickamauga, Ga., has been incorporated with a capital of $50,000, to manufacture refined oil products. The incorporators are J. P. Dunaway, Chickamauga; Frank P. Case and D. H. Mitchell, both of Chattanooga, Tenn.

THE PHARAOH PARCHMENT CO., San Francisco, Calif., has been incorporated with a capital of $50,000, to manufacture paper products. The incorporators are E. Hepner, G. E. Lund, J. Politizer and George A. Connolly, Mills Bldg., San Francisco. The last noted represents the company.

THE PALADO OIL CO., Houston, Tex., has been incorporated with a capital of $50,000, to manufacture petroleum products. The incorporators are F. H. Sheffield, Claude Kavanaugh and H. P. Porter, all of Houston.

THE M. A. WELLIN OIL CO., Syracuse, N. Y., care of C. S. Carr, White Memorial Bldg., Syracuse, representative, has been incorporated with a capital of $50,000, to manufacture oil products. The incorporators are M. A., F. and J. Wellin.

THE J. & J. CHEMICAL CO., Buffalo, N. Y., care of Clarence MacGregor, Ellicott Sq., Buffalo, representative, has been incorporated with a capital of $5,000, to manufacture chemicals and chemical byproducts. The incorporators are J. Sansone, and J. Barone.

THE VIM OIL CO., 175 West Jackson Blvd., Chicago, Ill., has been incorporated with a capital of $50,000, to manufacture oil products. The incorporators are A. J. Minster and Oscar A. Steffels.

THE STAR SMELTING & REFINING CO., Philadelphia, Pa., care of the Corporation Guarantee & Trust Co., Land Title Bldg., has been incorporated under Delaware laws, with a capital of $10,000, to manufacture refined metal products.

Capital Increases, etc.

THE BAKELITE CORP., 8 West 40th St., New York, N. Y., manufacturer of rubber composition products, has filed notice of increase in capital from $3,100,000 to $5,100,000.

THE REX STEEL STAMPING CO., Joliet, Ill., has filed notice of increase in capital from $40,000 to $100,000.

THE INLAND GLASS CO., Chicago, Ill., has filed notice of increase in capital from $1,500,000 to $2,000,000.

THE HERCULES POWDER CO., Wilmington, Del., has filed notice of increase in capital from $20,000,000 to $40,000,000.

THE MADISON TIRE & RUBBER CO., Buffalo, N. Y., is arranging for a bond issue of $750,000, a portion of the proceeds to be used for general expansion.

THE GENERAL REFRACTORIES CO., Oliver Bldg., Pittsburgh, Pa., has purchased the plants of the Hayes Run Fire Brick Co., Orviston, Pa., and the Pennsylvania Fire Brick Co., Beech Creek, Pa., at the same time increasing its capital to $18,000,000. The acquired properties will be merged with other plants recently secured in this district.

THE JOHN LUCAS CO., 322 Race St., Philadelphia, Pa., manufacturer of paints, varnishes, etc., has arranged for an increase in capital from $1,500,000 to $7,000,000.

Herman Ringel and William C. Ridgway have been appointed receivers for the HOBOKEN PAPER MILL CO., 1 Newark St., Hoboken, N. J. The assets are stated to be $798,000, and liabilities, $759,100.

THE INDEPENDENT OIL & GAS CO., Okmulgee, Okla., is arranging to increase its capital to $10,000,000 for proposed expansion.

Industrial Notes

THE CUTLER-HAMMER MFG. CO., Milwaukee, Wis., in order to give greater attention to business in western New York and the Province of Ontario, has opened a branch office at 358 Ellicott Sq., Buffalo, N. Y. B. A. Hansen, formerly located in the New York office, has been placed in charge.

THE DURIRON CO., INC., Dayton, O., has opened an office at 495 Ellicott Sq., Buffalo, N. Y., to take care of business in that territory. The new office will be in charge of N. E. Philpot, who for the past 2 years has been engineer in charge of the company's Cleveland office.

AUTOMATIC & ELECTRIC FURNACES, LTD., has moved to larger works and offices at 173-175 Farrington Road, London, E C. 1, England. In addition to the Wild-Barfield electric furnaces and laboratory muffles it is introducing new types of muffles for laboratory use, etc.

THE SEMET-SOLVAY CO., Syracuse, N. Y., has been awarded a contract for the construction of a byproduct coke plant of 500 tons daily capacity for the Hoskins Iron & Steel Co., Sydney, New South Wales, Australia. The contract has been awarded as a result of competitive tests on low-grade "zig-zag" Australian coal.

THE WESTON ELECTRICAL INSTRUMENT CO., of Newark, N. J., announces that G. P. Atkinson has opened an office in Atlanta, Ga., for the territory of Georgia, South Carolina and northern Alabama. In addition to Weston instruments, Mr. Atkinson has in charge the sale of other electrical equipment. This company also announces a new line of small portable instruments for use on alternating-current circuits, known as "Weston, Jr." The group comprises wattmeters, voltmeters, ammeters and milliameters.

THE HERCULES POWDER CO., Wilmington, Del., has recently employed the following men at various plants and the research station: Roderick Eskew, Roy S. Hancock, Carl B. Durr, Robert C. Brown, B. I. Stoops, Charles W. Woodrow, H. W. Botts and H. F. Krueger.

Manufacturers' Catalogs

THE BROWN HOISTING MACHINERY CO., Cleveland, O., has issued Catalog L. on Brownhoist drop-forged chain for conveyors and elevators. Copies will be mailed to any reader who is interested.

THE METAL & THERMIT CORP., New York, has issued the fourth edition of its Thermit Locomotive Pamphlet, No. 21, which is of interest to railroad superintendents of motive power, general foremen, blacksmith foremen and Thermit welders. The new pamphlet contains many revisions since the last edition was published, chief among which are instructions for applying important improvements in practice in Thermit welding which have been developed by exhaustive research. The drawings and instructions illustrate and describe the making of Thermit welds in various parts of locomotive frames and other locomotive and railroad equipment, and show improved practice.

THE CENTURY WOOD PRESERVING CO., Pittsburgh, Pa., has issued Bull. 24, on "Treated Ties and Timbers for Industrial Plants."

BALLARD, SPRAGUE & CO., New York, are issuing a new catalog on boiler settings and chimneys. Illustrations of actual installations are given as well as descriptive matter.

THE COLORADO IRON WORKS CO., Denver, Colo., in Catalog 32-B discusses the drying of fine materials, with a description of the Lowden patent drier.

THE JEFFREY MFG. CO., Columbus, O., has published three new catalogs: No. 277, "Jeffrey Machinery for Fertilizer Plants," which has 35 pages of illustrations and description and data covering equipments which have a wide range of service in the handling and treatment of materials in the fertilizer and allied industries; No. 258, which illustrates and describes Jeffrey Standard Apron Conveyors in both wood and steel types; and No. 368, which is on Jeffrey Swing Hammer Pulverizers adapted for reducing all kinds of friable materials. This catalog has 42 pages of description, data and other information, together with numerous shop illustrations and installation views showing the wide application of Jeffrey swing hammer pulverizers.

Coming Meetings and Events

AMERICAN CHEMICAL SOCIETY will hold its spring meeting April 3 to 7, 1923, at New Haven, Conn.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its spring meeting May 3, 4 and 5, 1923, at the Commodore Hotel, New York City.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its winter meeting at Richmond, Va., Dec. 7 to 9.

INTERNATIONAL CHAMBER OF COMMERCE will hold its second general meeting in Rome, Italy, March 19-26, 1923.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING will be held at the Grand Central Palace Dec. 7-13, with the exception of the intervening Sunday.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

The following meetings are scheduled to be held in Rumford Hall, Chemists' Club, 52 East 41st St., New York City, Nov. 10—American Chemical Society (in charge), Society of Chemical Industry, American Electrochemical Society, Société de Chimie Industrielle, joint meeting. Nov. 17—American Electrochemical Society, regular meeting. Dec. 1—Society of Chemical Industry, regular meeting. Dec. 8—American Chemical Society, regular meeting. Jan. 5—American Chemical Society, regular meeting. Jan. 12—Society of Chemical Industry, Perkin Medal. Feb. 9—American Electrochemical Society (in charge), Society of Chemical Industry, Société de Chimie Industrielle, American Chemical Society, joint meeting. March 9—American Chemical Society, Nichols Medal. March 23—Society of Chemical Industry, regular meeting. April 20—Society of Chemical Industry (in charge), American Electrochemical Society, Société de Chimie Industrielle, American Chemical Society, joint meeting. May 4—American Chemical Society, regular meeting. May 11—Société de Chimie Industrielle (in charge), American Chemical Society, American Electrochemical Society, Society of Chemical Industry, joint meeting. May 18—Society of Chemical Industry, regular meeting. June 8—American Chemical Society, regular meeting.